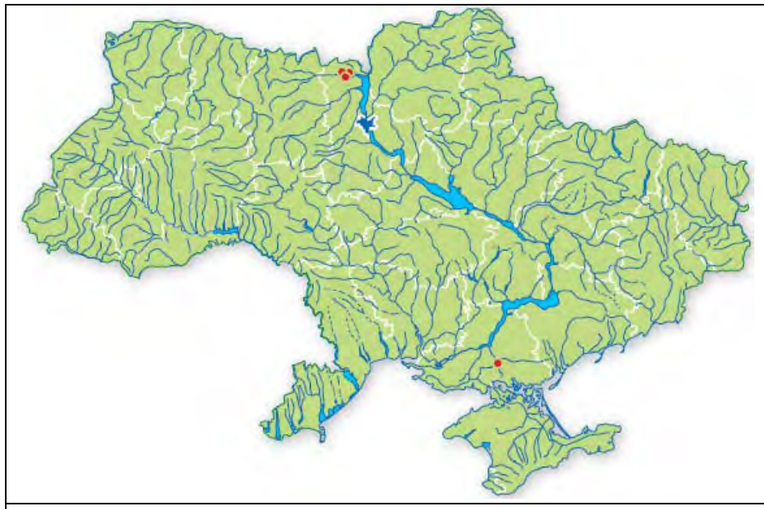
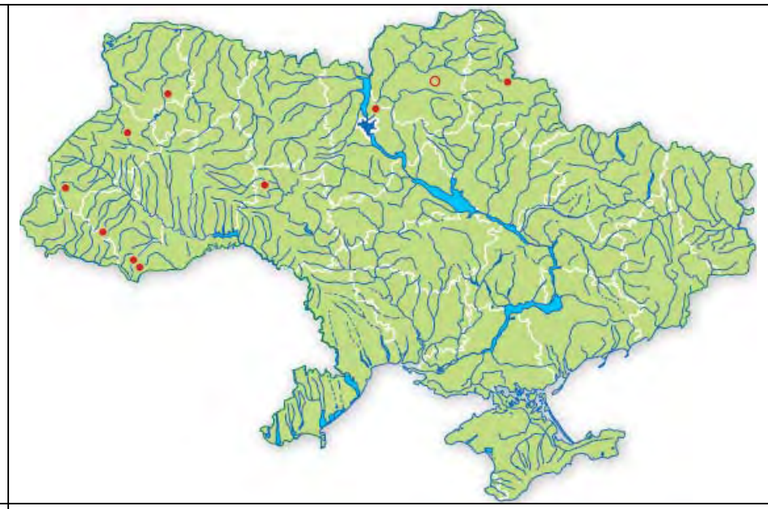
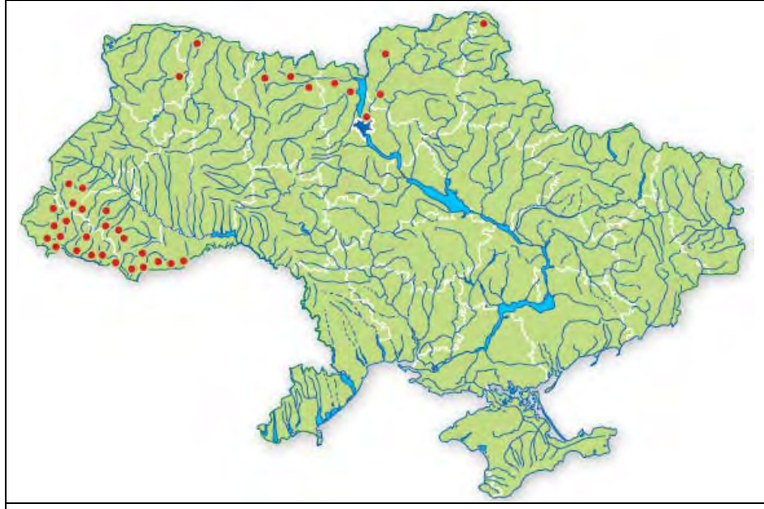


Horse *(Equus caballus)*

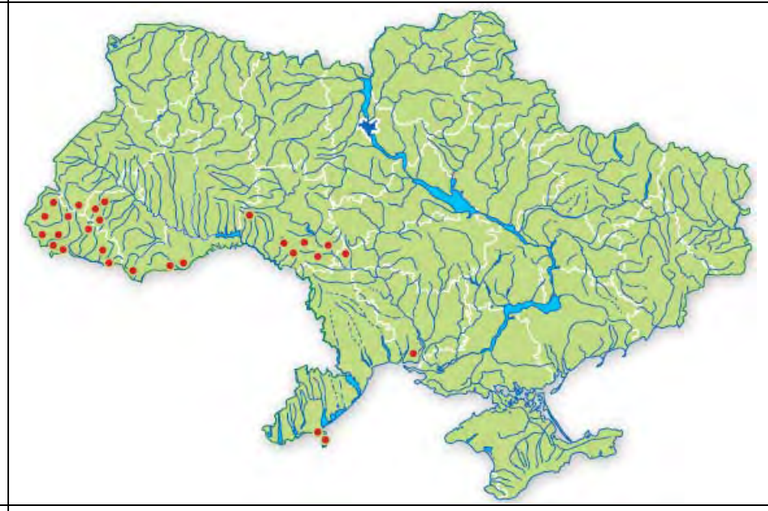


European Bison *(Bison bonasus)*

Lesser Mole Rat *(Nannospalax leucodon)*



Eurasian Lynx *(Lynx lynx)*



Wildcat *(Felis sylvestris)*

Russian Desman *(Desmana moschata)*

Key: O - Distribution pre 1984; ● - Distribution post 1984; ? – Likely but unconfirmed distribution.

Figure 3-19: Ukraine Species Distribution Data for Red Data Book Mammals, excluding bats (Table 1/3)

Source: Red Data Book of Ukraine, 2009

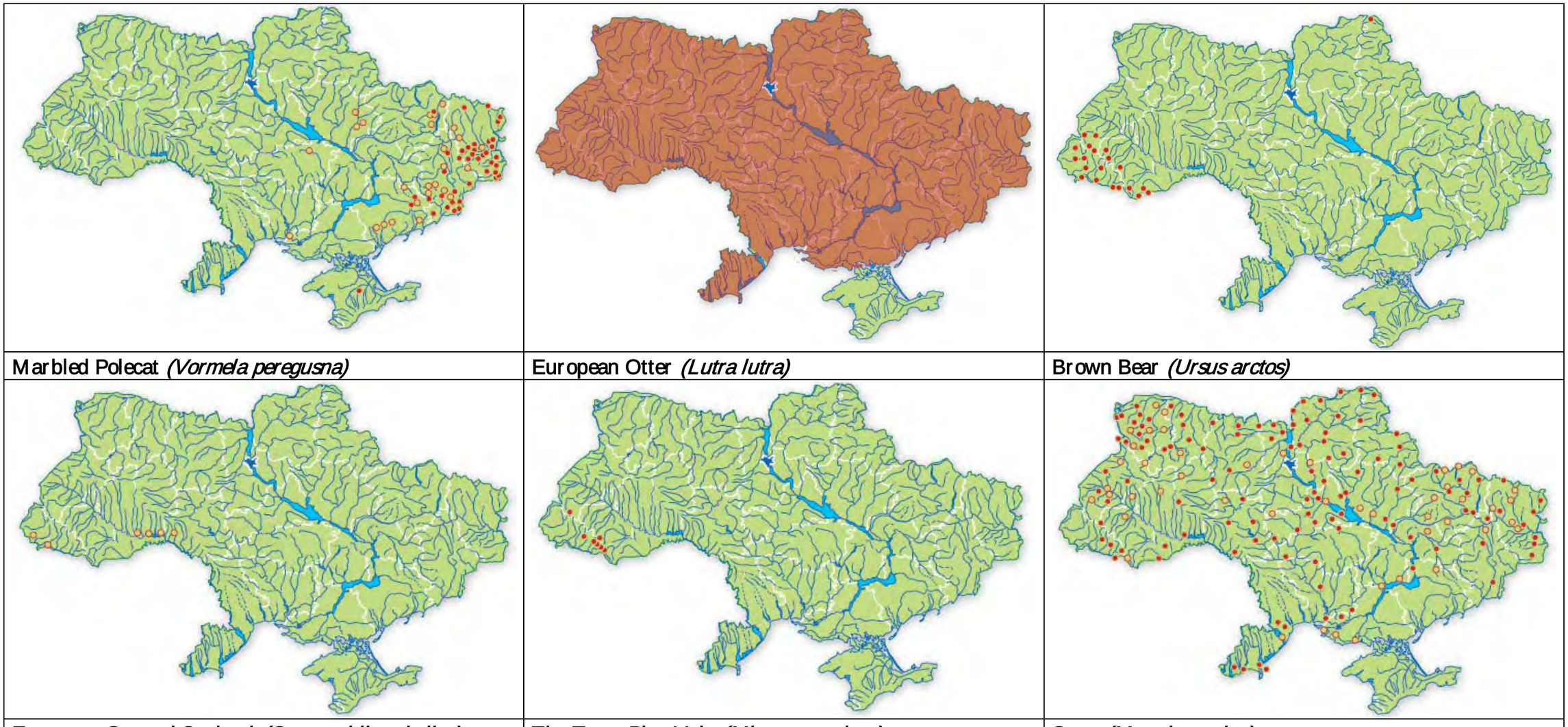


Figure 3-20: Ukraine Species Distribution Data for Red Data Book Mammals, excluding bats (Table 2/3)

Source: Red Data Book of Ukraine, 2009

Podolsk Mole Rat (*Spalax zemni*)

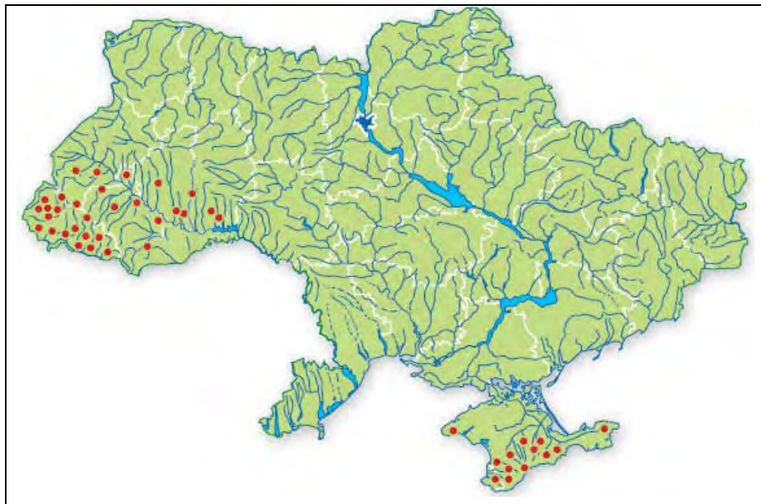
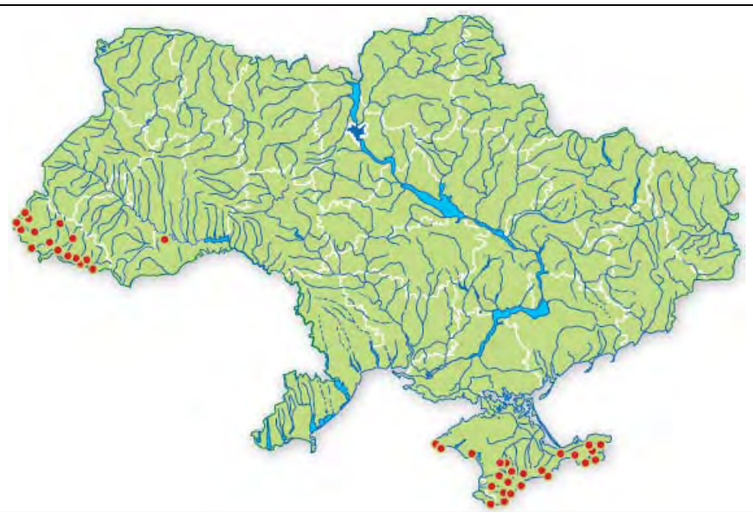
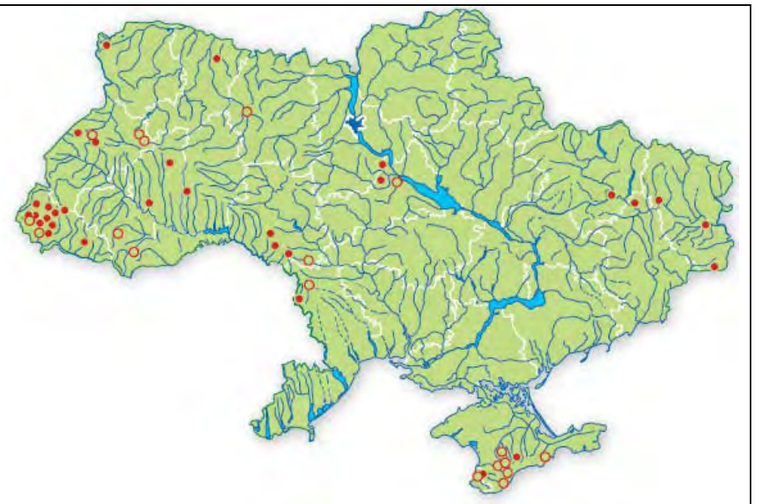
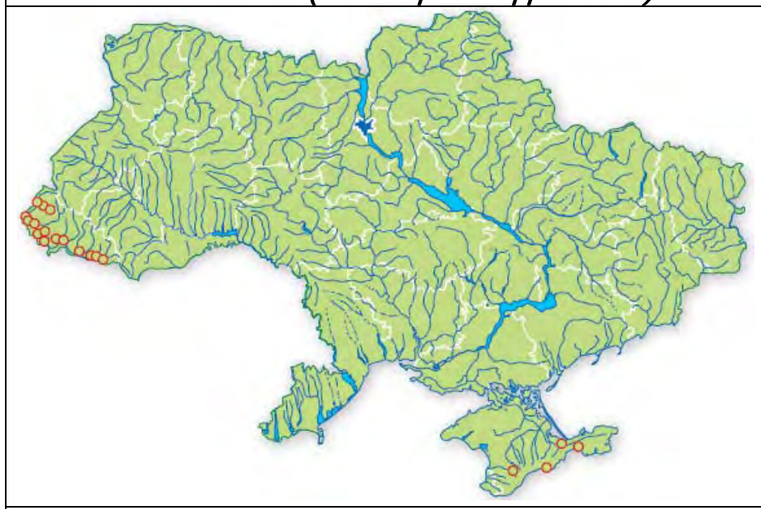
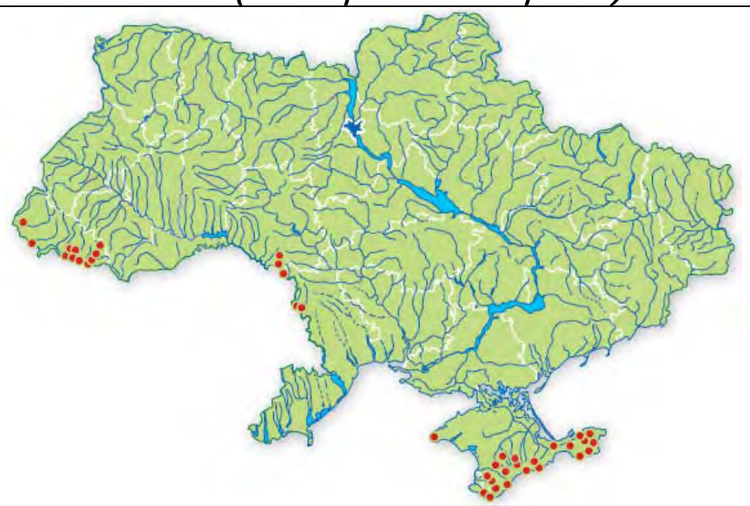
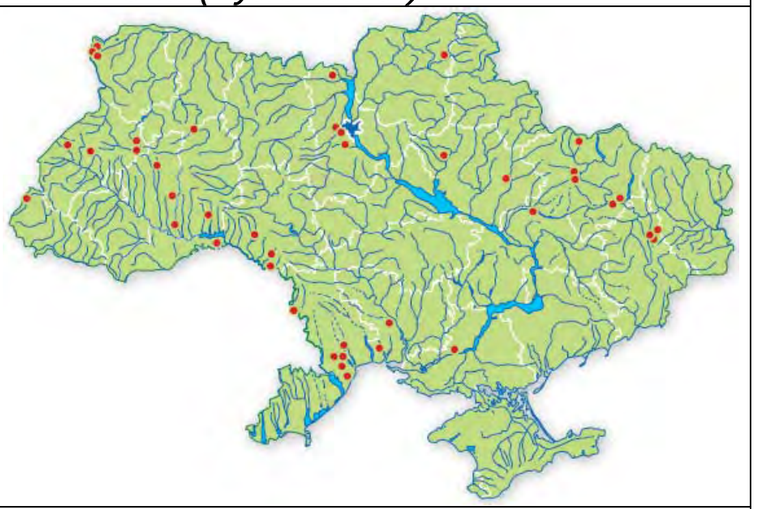
Great Jerboa (*Allactaga jaculus*)

Southern Birch Mouse (*Sicista subtilis*)

Key: O - Distribution pre 1984; ● - Distribution post 1984; ? – Likely but unconfirmed distribution.

Figure 3-21: Ukraine Species Distribution Data for Red Data Book Mammals, excluding bats (Table 3/3)

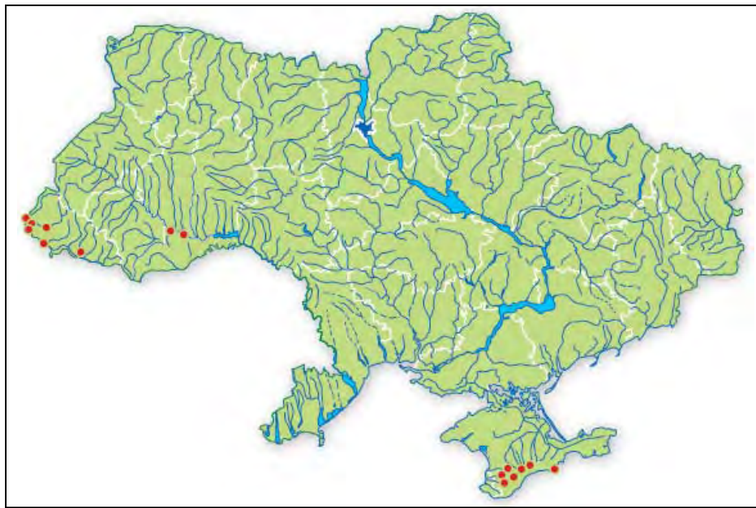
Source: Red Data Book of Ukraine, 2009

		
Lesser Horseshoe Bat *(Rhinolophus hipposideros)*	Greater Horseshoe Bat *(Rhinolophus ferrumequinum)*	Natterer's Bat *(Myotis nattereri)*
		
Schreibers's Long-fingered Bat *(Miniopterus schreibersii)*	Lesser Mouse-eared Bat *(Myotis blythii)*	Pond Myotis *(Myotis dasycneme)*

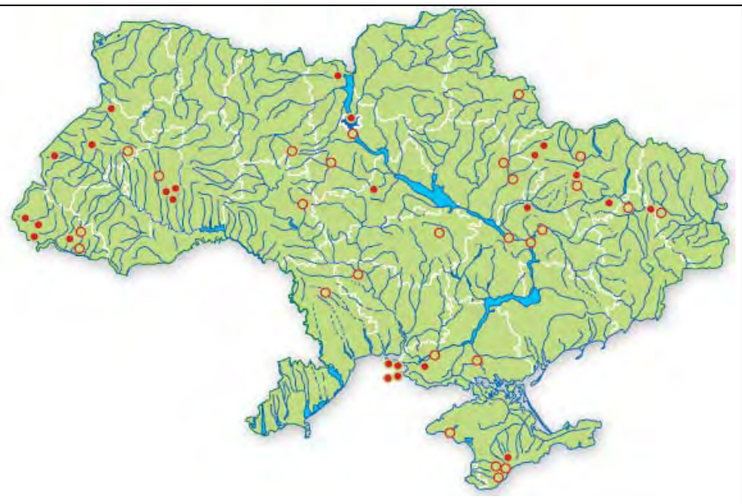
Key: ○ - Distribution pre 1984; ● - Distribution post 1984; ? – Likely but unconfirmed distribution.

Figure 3-22: Ukraine Species Distribution Data for Red Data Book Bats (Table 1/4)

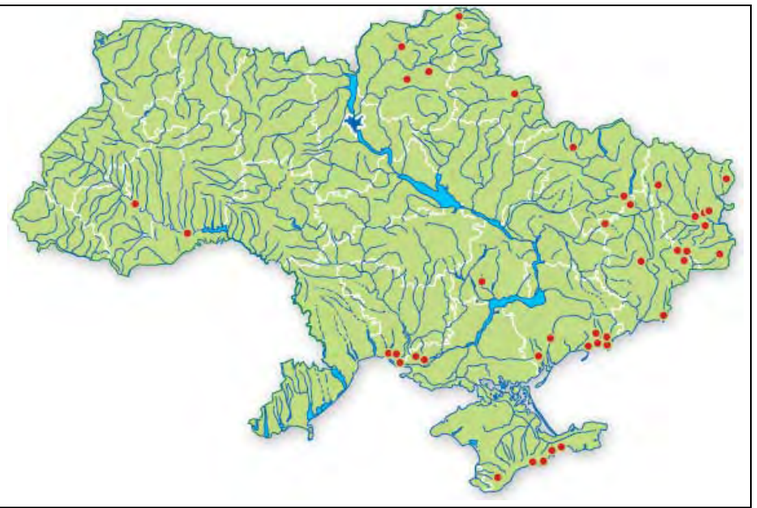
Source: Red Data Book of Ukraine, 2009



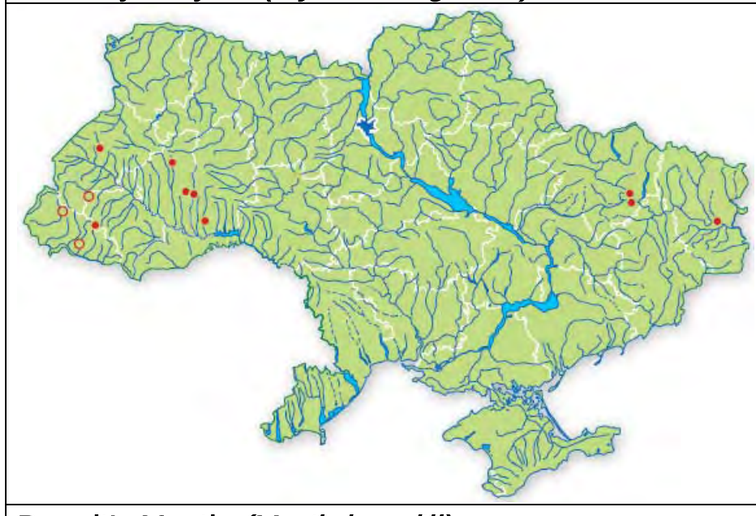
Geoffroy's Myotis *(Myotis emarginatus)*



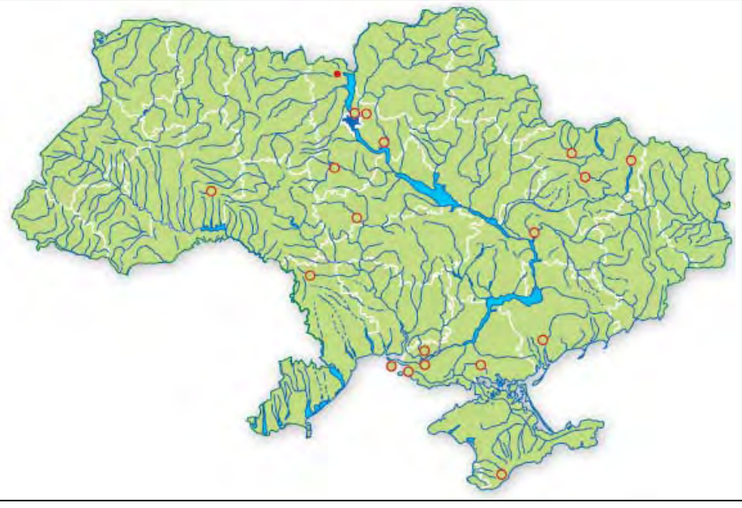
Leisler's Noctule *(Nyctalus leisleri)*



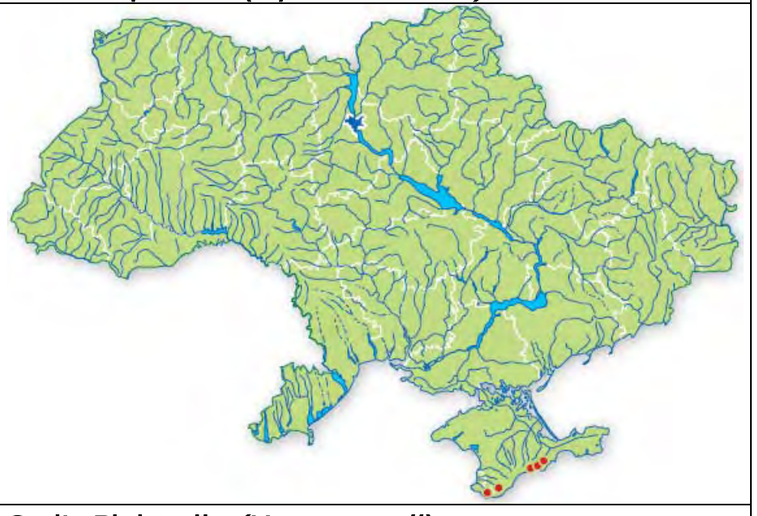
Kuhl's Pipistrelle *(Pipistrellus kuhlii)*



Brandt's Myotis *(Myotis brandtii)*



Giant Noctule *(Nyctalus lasiopterus)*



Savi's Pipistrelle *(Hypsugo savii)*

Key: ○ - Distribution pre 1984; ● - Distribution post 1984; ? – Likely but unconfirmed distribution.

Figure 3-23: Ukraine Species Distribution Data for Red Data Book Bats (Table 2/4)

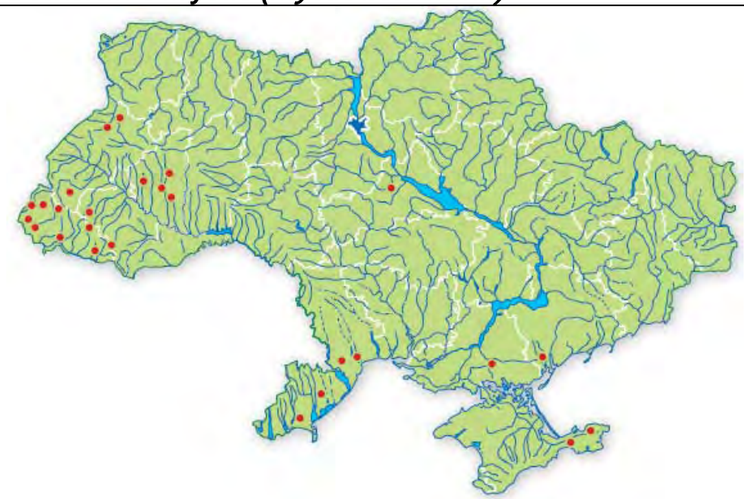
Source: Red Data Book of Ukraine, 2009

Mouse-eared Myotis *(Myotis myotis)*

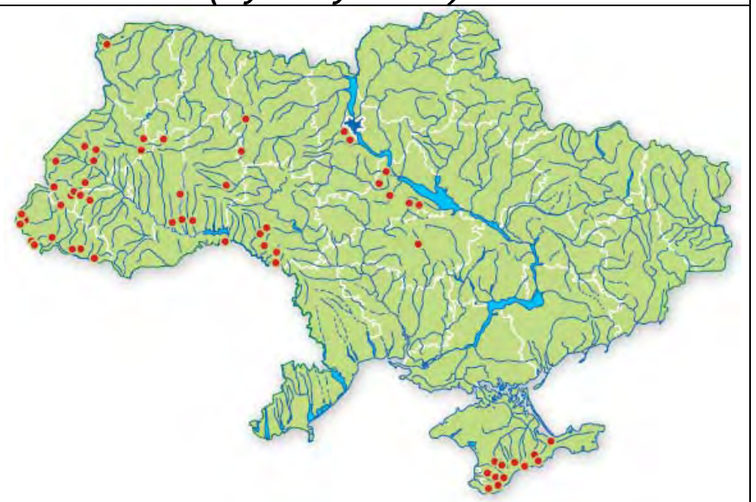
Bechstein's Myotis *(Myotis bechsteinii)*

Whiskered Bat *(Myotis mystacinus)*

Brown Long-eared Bat *(Plecotus auritus)*



Grey Long-eared Bat *(Plecotus austriacus)*

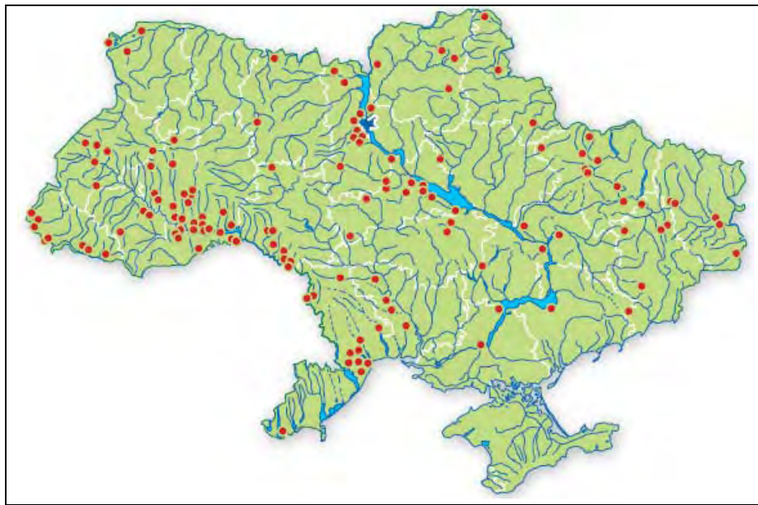
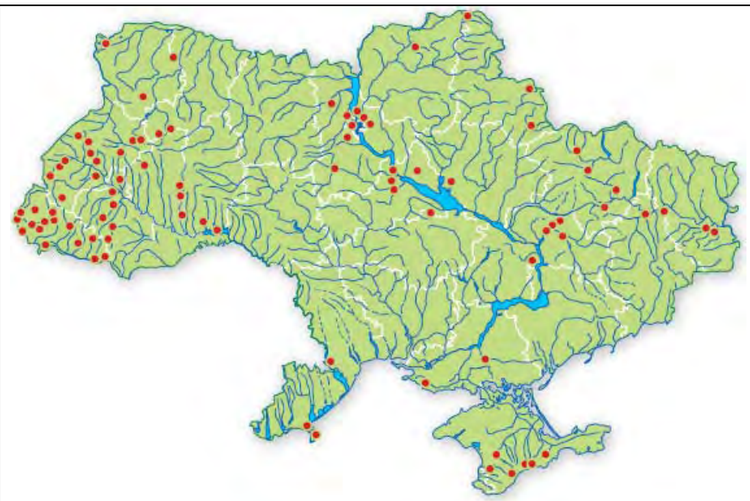
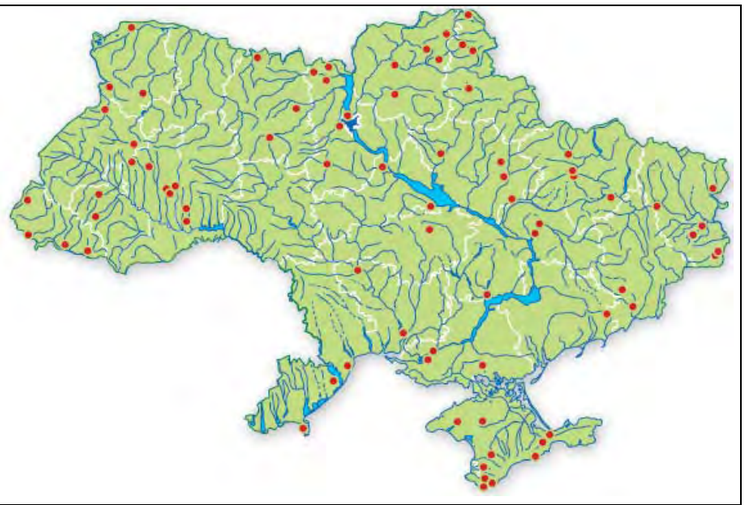
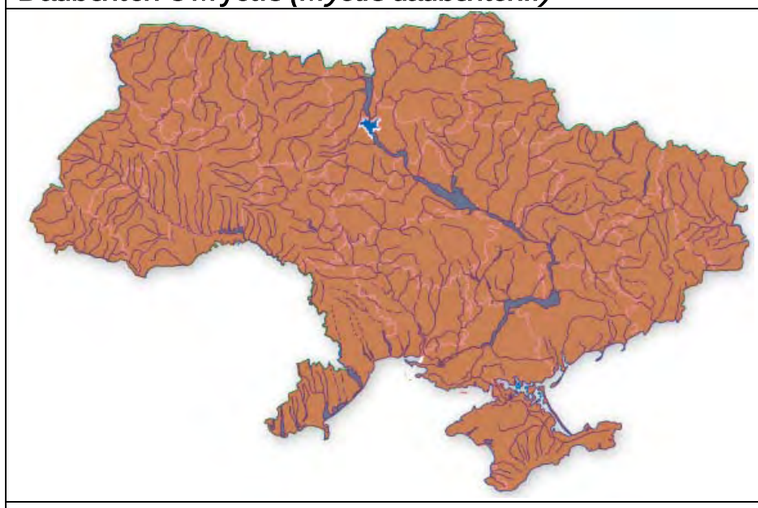
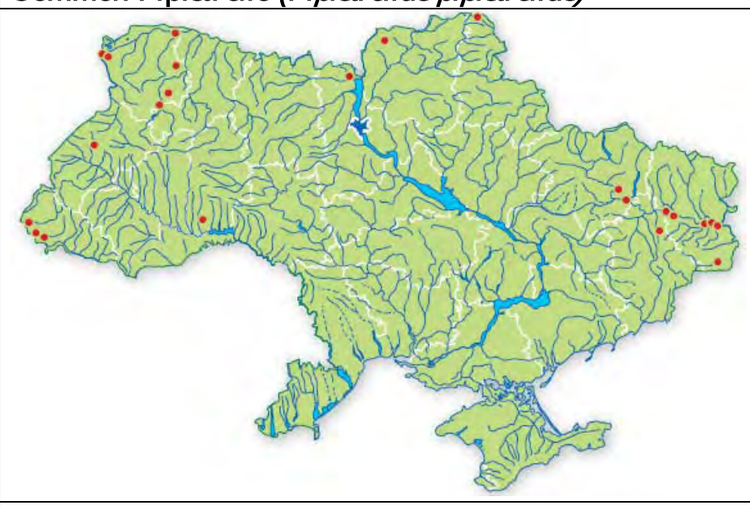
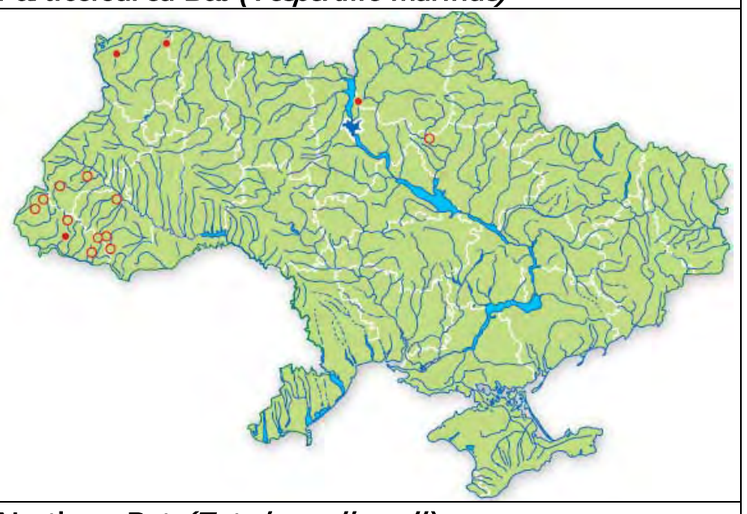


Western Barbastelle *(Barbastella barbastellus)*

Key: ○ - Distribution pre 1984; ● - Distribution post 1984; ? – Likely but unconfirmed distribution.

Figure 3-24: Ukraine Species Distribution Data for Red Data Book Bats (Table 3/4)

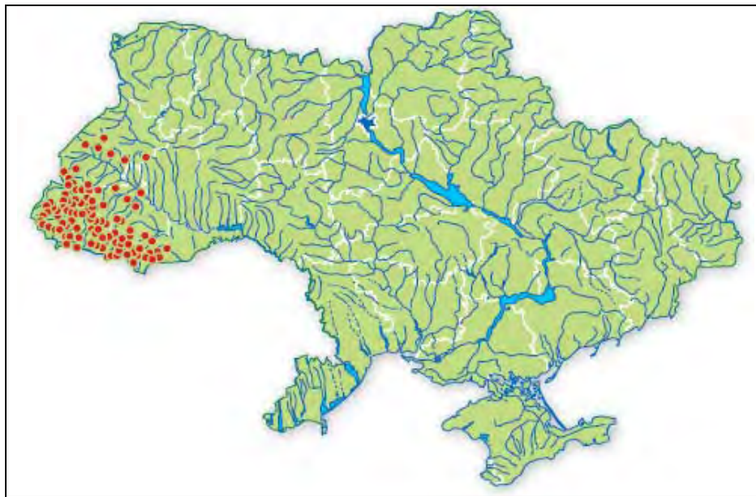
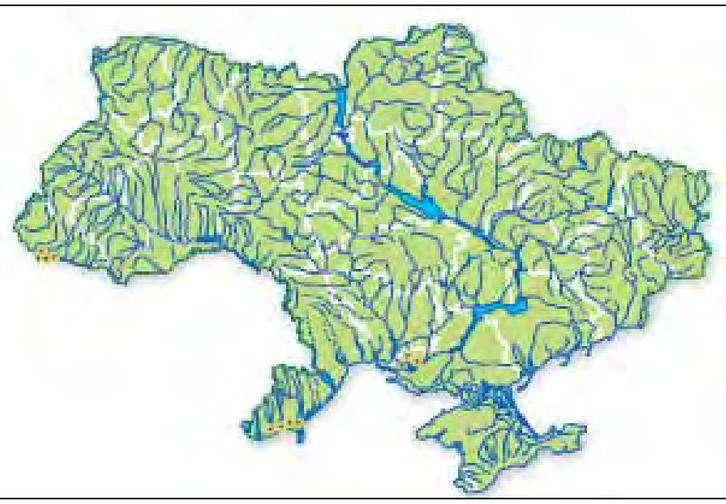
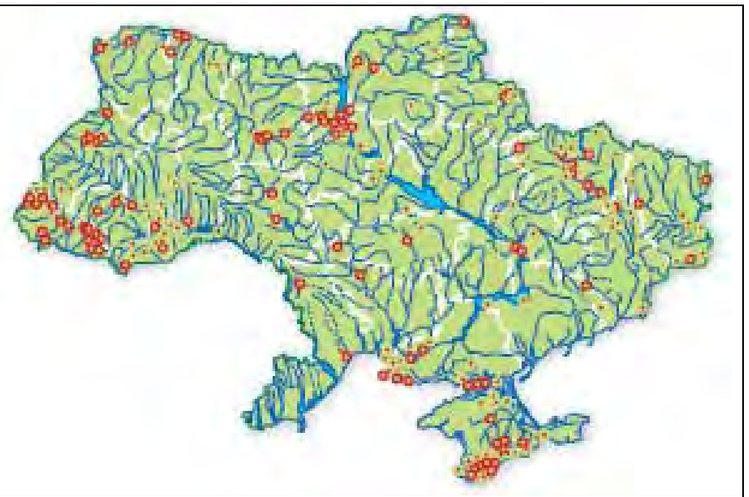
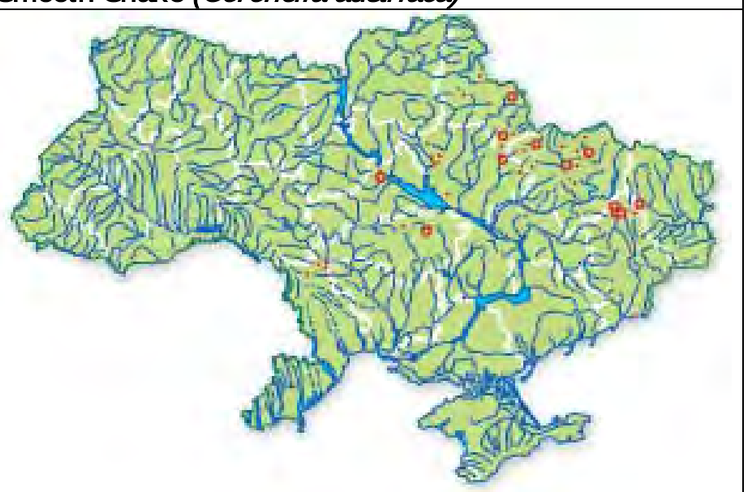
Source: Red Data Book of Ukraine, 2009

		
Daubenton's Myotis *(Myotis daubentonii)*	Common Pipistrelle *(Pipistrellus pipistrellus)*	Particoloured Bat *(Vespertilio murinus)*
		
Common Noctule *(Nyctalus noctula)*	Soprano Pipistrelle *(Pipistrellus pygmaeus)*	Northern Bat *(Eptesicus nilssonii)*
Nathusius' Pipistrelle Bat *(Pipistrellus nathusii)* and Serotine Bat *(Eptesicus serotinus)* found throughout the country.		

Key: ○ - Distribution pre 1984; ● - Distribution post 1984; ? – Likely but unconfirmed distribution.

Figure 3-25: Ukraine Species Distribution Data for Red Data Book Bats (Table 4/4)

Source: Red Data Book of Ukraine, 2009

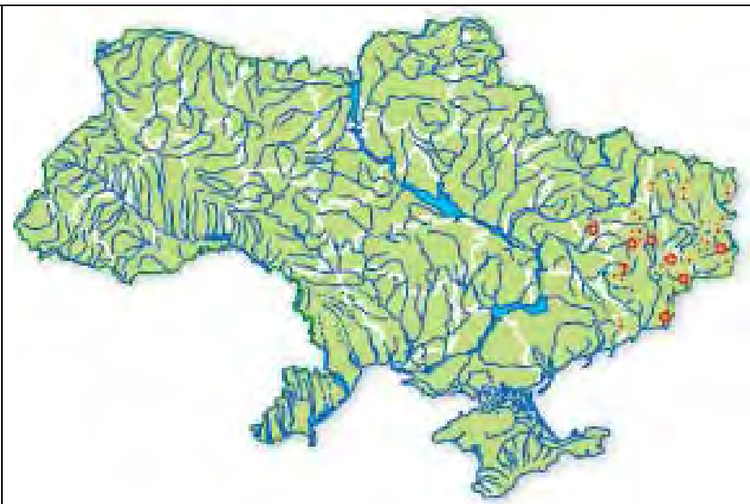
		
Fire Salamander *(Salamandra salamandra)*	Danube Crested Newt *(Triturus dobrogicus)*	Smooth Snake *(Coronella austriaca)*
		
Southern Crested Newt *(Triturus karelinii)*	European Green Lizard *(Lacerta viridis)*	Nikolsky's Adder *(Vipera nikolskii)*

Key: ○ - Distribution pre 1984; ● - Distribution post 1984; ? – Likely but unconfirmed distribution.

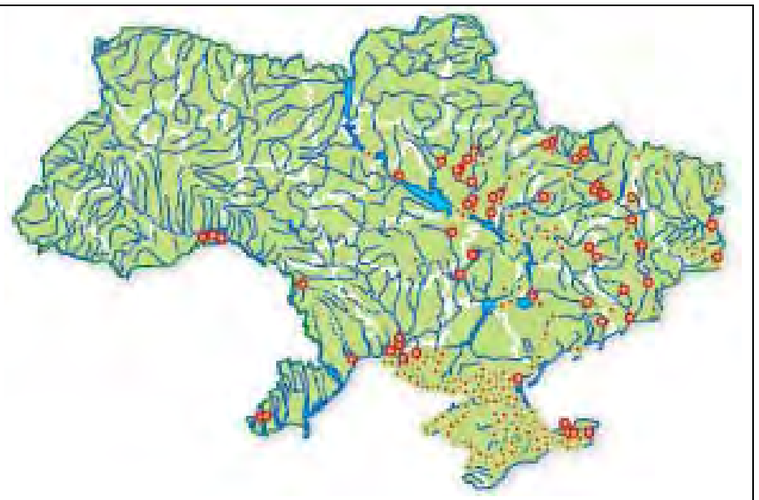
Figure 3-26: Ukraine Species Distribution Data for Red Data Book Reptiles and Amphibians (Table 1/2)

Source: Red Data Book of Ukraine, 2009

Caspian Whipsnake *(Coluber caspius)*



Steppe Ratsnake *(Elaphe dione)*



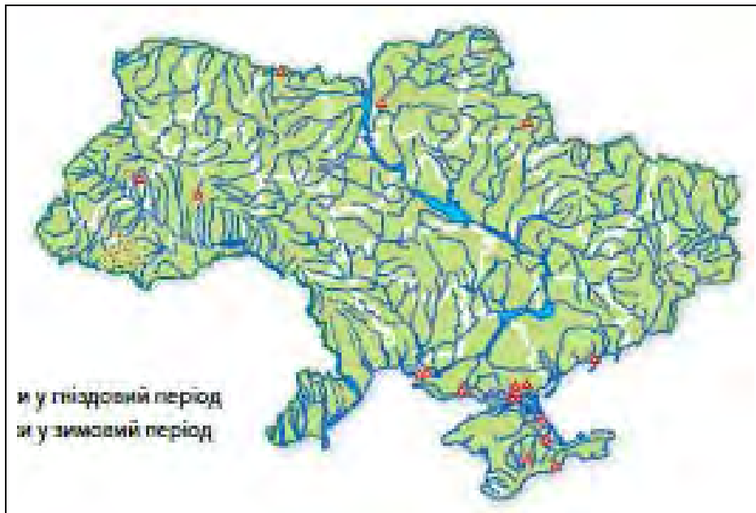
Steppe Viper *(Vipera renardi)*

East-four-lined Ratsnake *(Elaphe sauromates)*

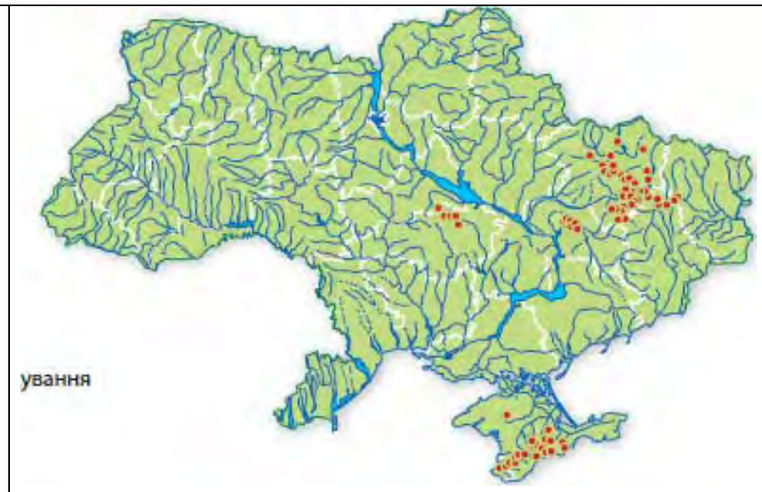
Key: O - Distribution pre 1984; ● - Distribution post 1984; ? – Likely but unconfirmed distribution.

Figure 3-27: Ukraine Species Distribution Data for Red Data Book Reptiles and Amphibians (Table 2/2)

Source: Red Data Book of Ukraine, 2009

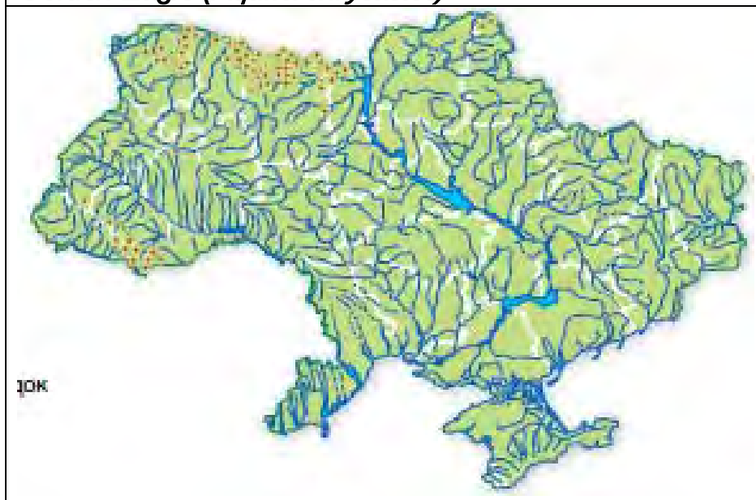


Golden Eagle *(Aquila chrysaetos)*

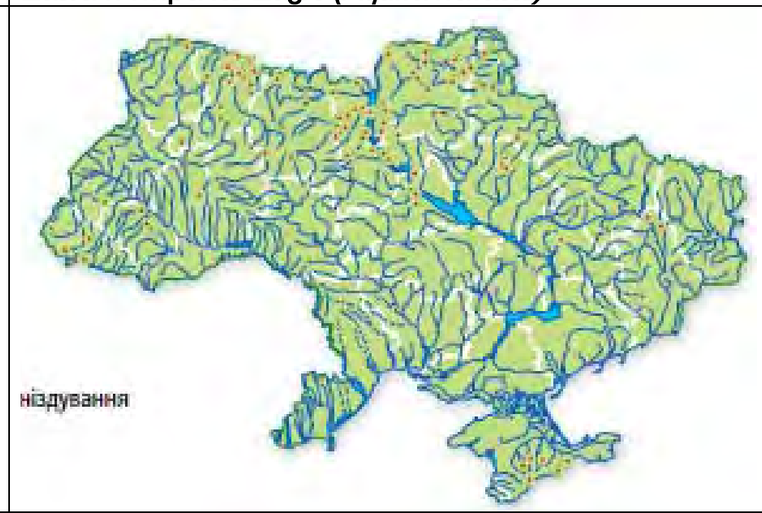


Eastern Imperial Eagle *(Aquila heliacal)*

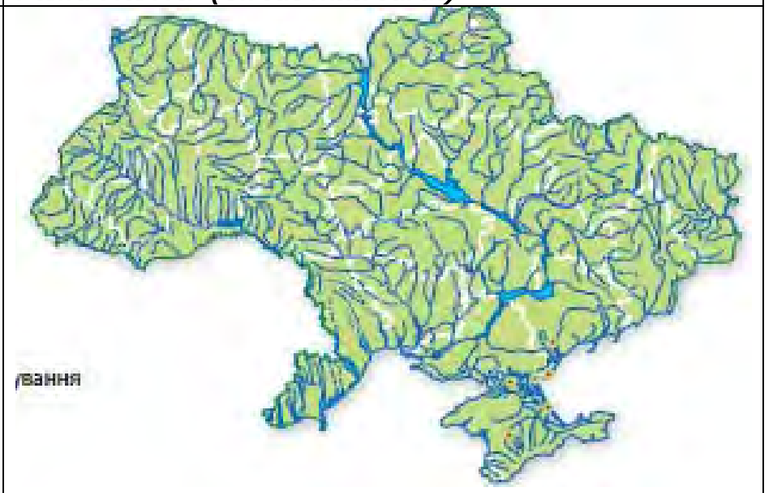
Pallid Harrier *(Circus macrourus)*



Capercaillie *(Tetrao urogallus)*



Short-toed Eagle *(Circaetus gallicus)*

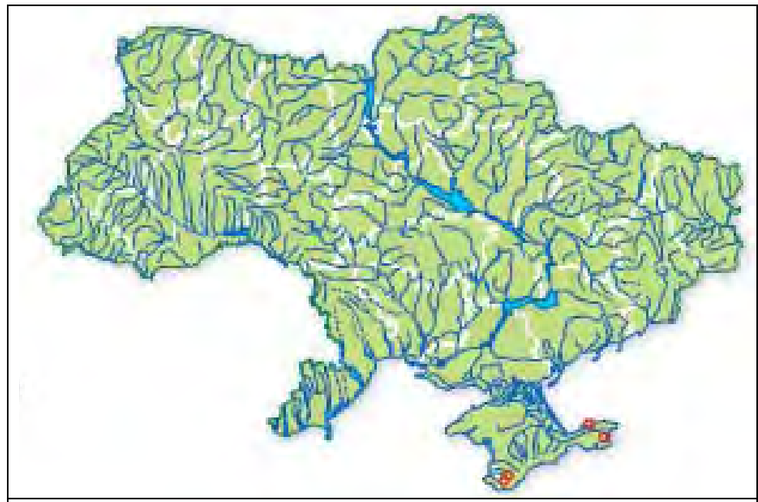


Black-winged Pratincole *(Glareola normannii)*

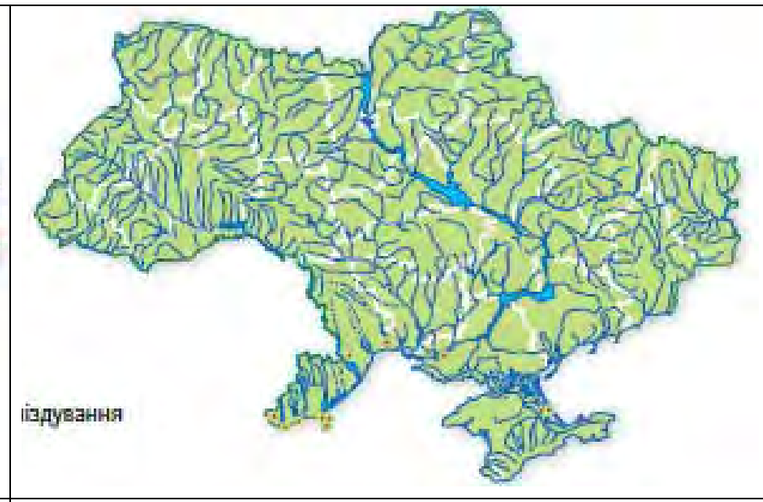
- Vagrants; - Nesting sites; - Wintering sites; - Migration sites

Figure 3-28: Ukraine Species Distribution Data for Red Data Book Birds (Table 1/5)

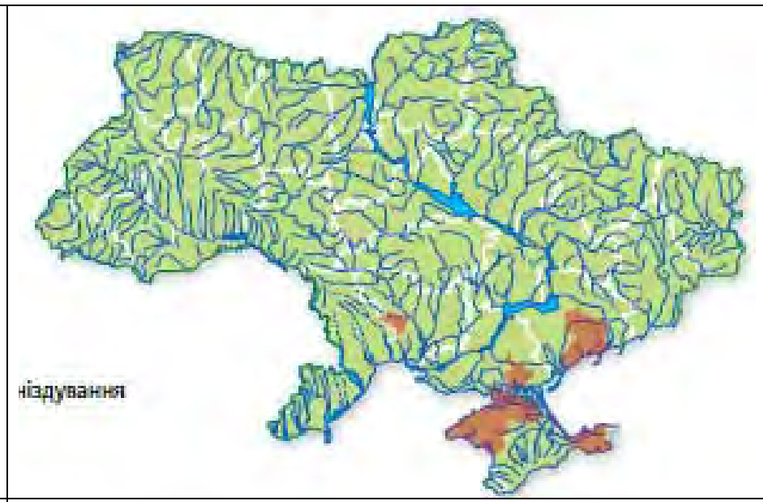
Source: Red Data Book of Ukraine, 2009



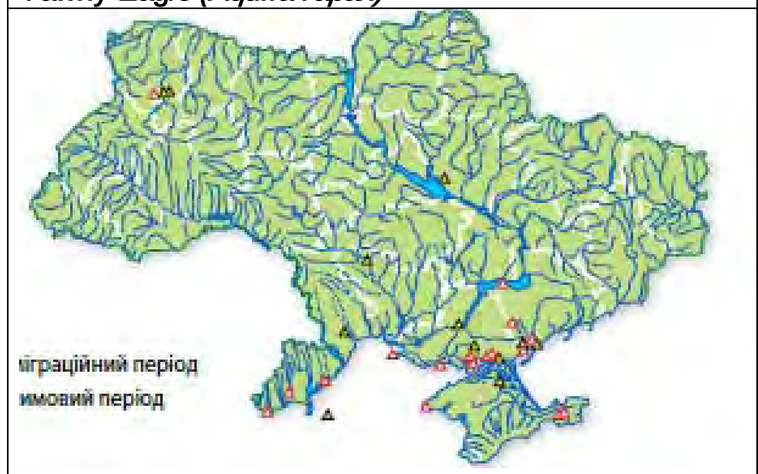
Tawny Eagle *(Aquila rapax)*



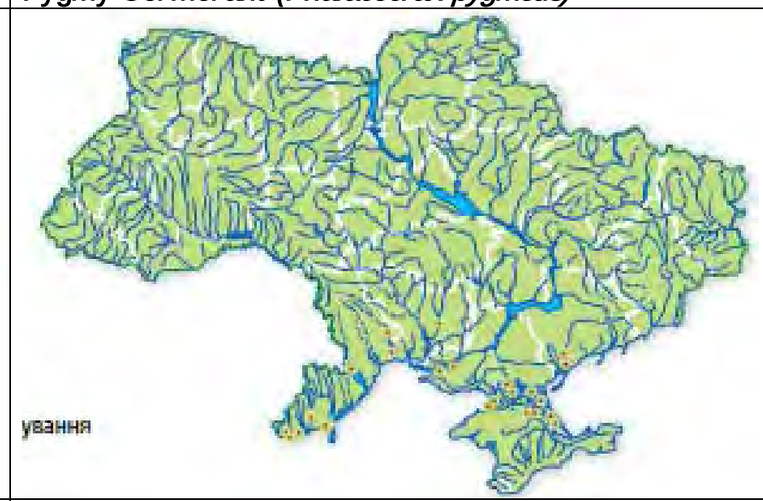
Pygmy Cormorant *(Phalacocrax pygmeus)*



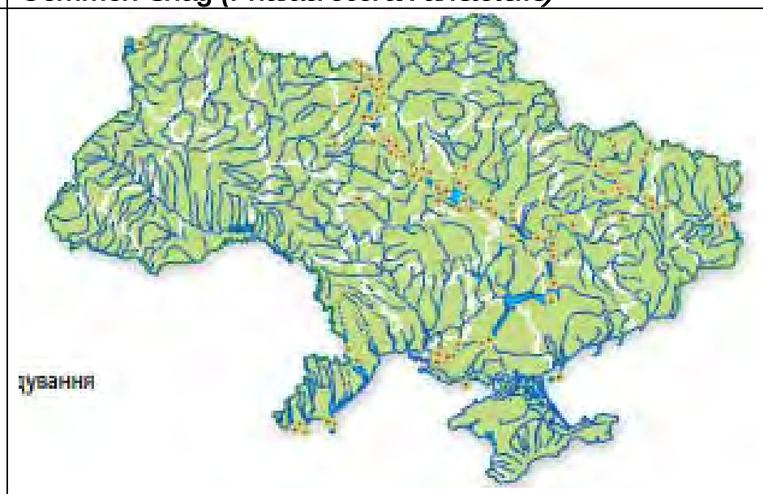
Common Shag *(Phalacrocorax aristotelis)*



Red-breasted Goose *(Rufibrenta ruficollis)*



Glossy Ibis *(Plegadis falcinellis)*

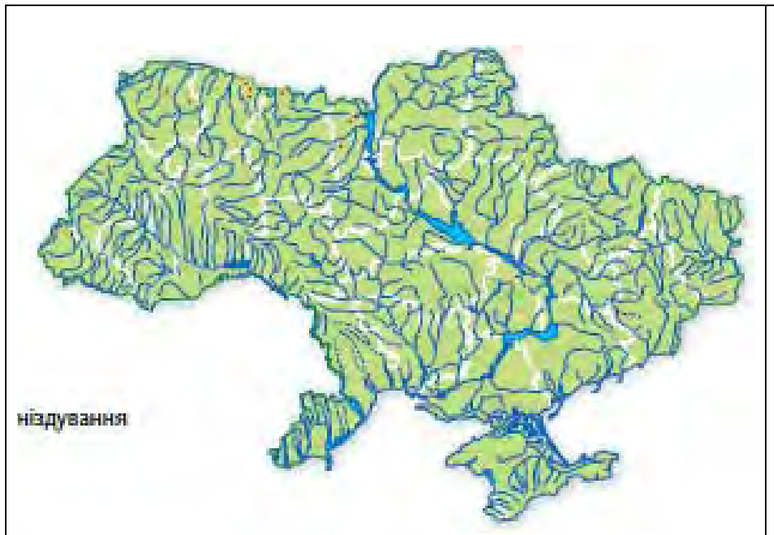


White-tailed Eagle *(Haliaeetus albicilla)*

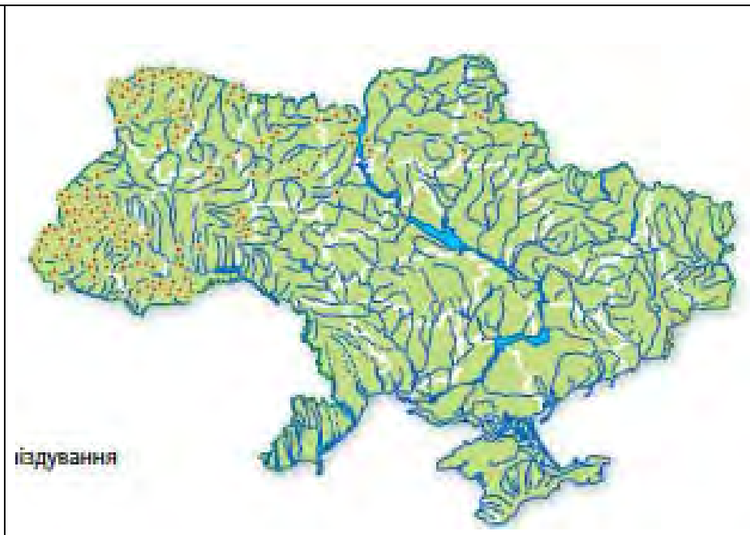
- Vagrants; - Nesting sites; - Wintering sites; - Migration sites

Figure 3-29: Ukraine Species Distribution Data for Red Data Book Birds (Table 2/5)

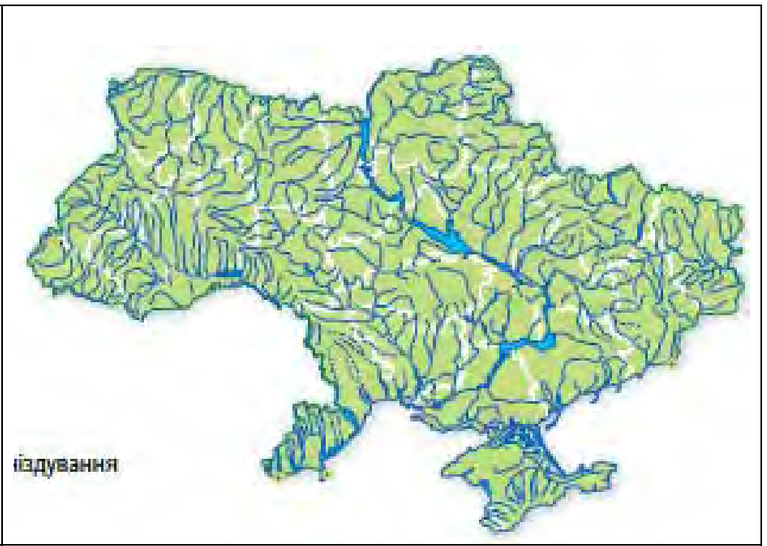
Source: Red Data Book of Ukraine, 2009



Great Grey Owl *(Strix nebulosa)*



Black Stork *(Ciconia nigra)*



Dalmatian Pelican *(Pelecanus crispus)*

Common Crane *(Grus grus)*

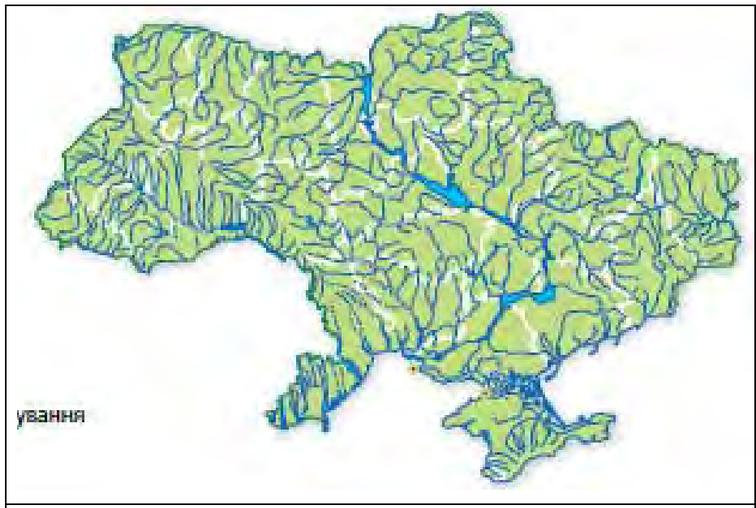
Aquatic Warbler *(Acrocephalus paludicola)*

Slender-billed Curlew (Numenius tenuirostris)

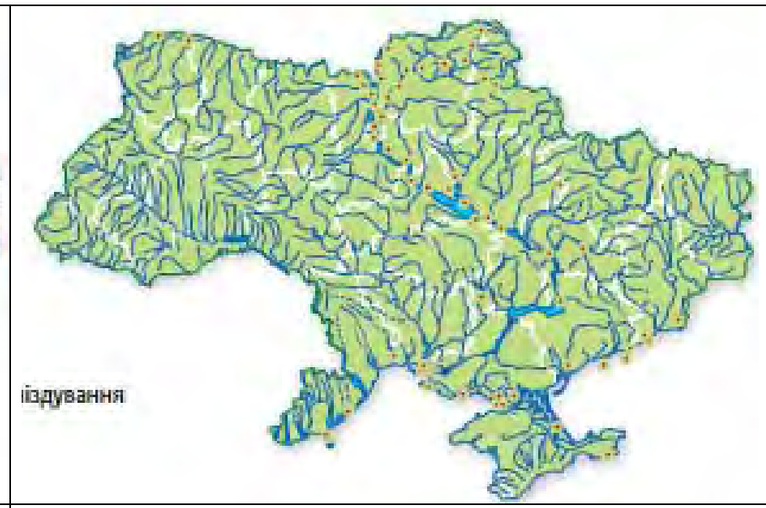
- Vagrants; - Nesting sites; - Wintering sites; - Migration sites

Figure 3-30: Ukraine Species Distribution Data for Red Data Book Birds (Table 3/5)

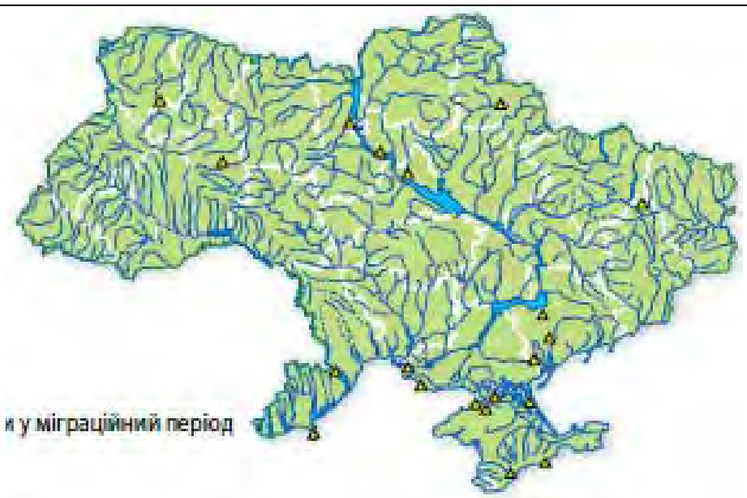
Source: Red Data Book of Ukraine, 2009



White Pelican *(Pelecanus onocrotalus)*

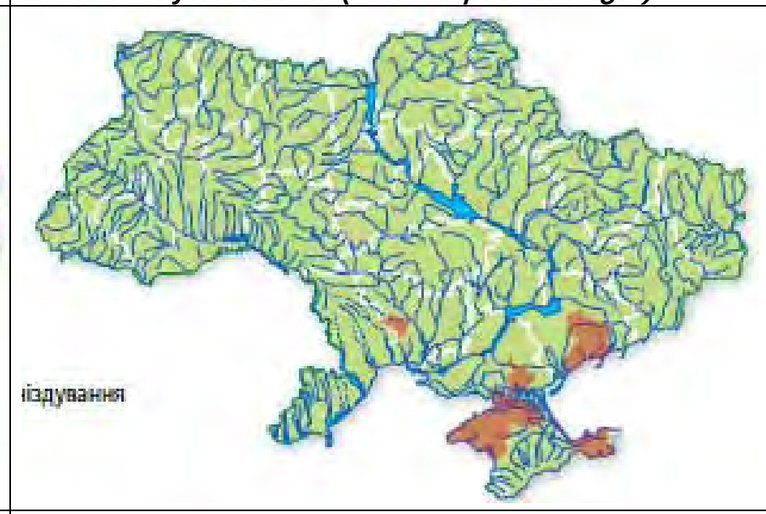


Eurasian Oystercatcher *(Haematopus ostralegus)*

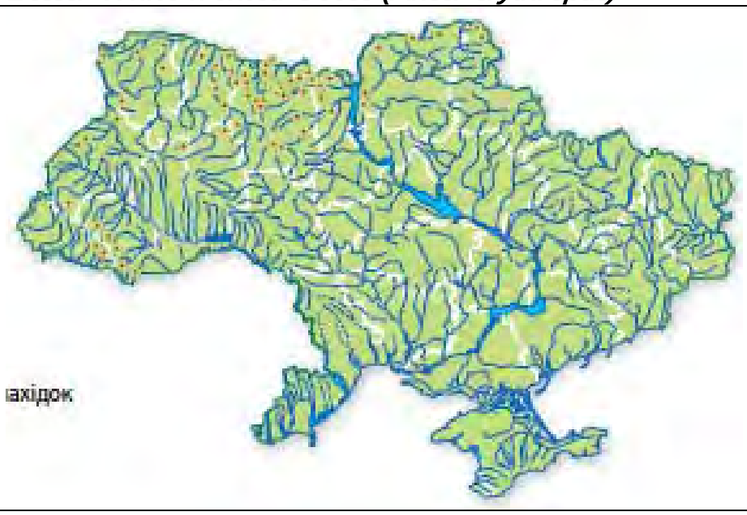


Lesser White-fronted Goose *(Anser erythropus)*

Ferruginous Duck *(Aythya nyroc)*



Great Bustard *(Otis tarda)*

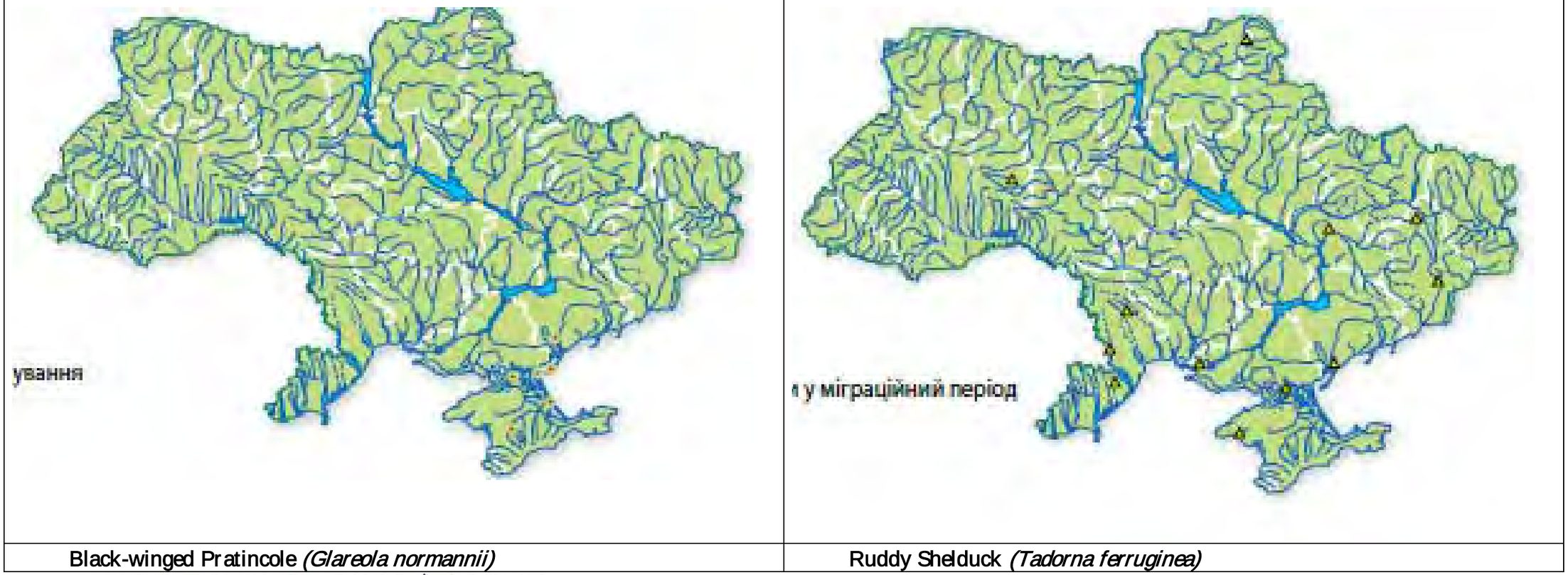


Black Grouse *(Tetrao tetrix)*

- Vagrants; - Nesting sites; - Wintering sites; - Migration sites

Figure 3-31: Ukraine Species Distribution Data for Red Data Book Birds (Table 4/5)

Source: Red Data Book of Ukraine, 2009



Black-winged Pratincole *(Glareola normannii)*	Ruddy Shelduck *(Tadorna ferruginea)*

Figure 3-32: Ukraine Species Distribution Data for Red Data Book Birds (Table 5/5)

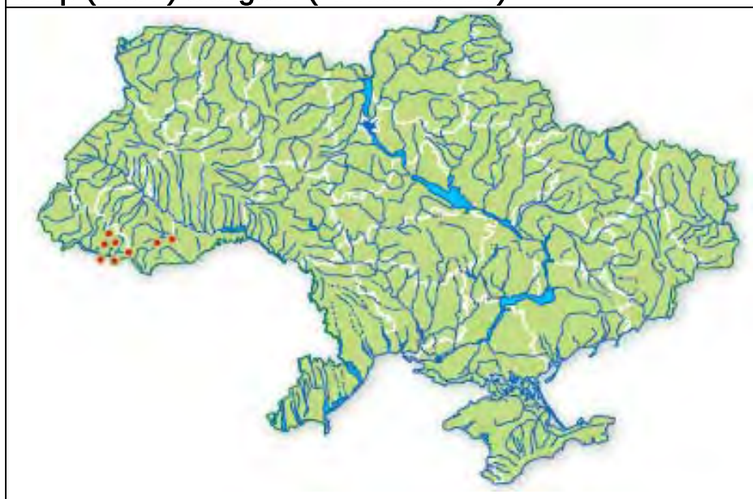
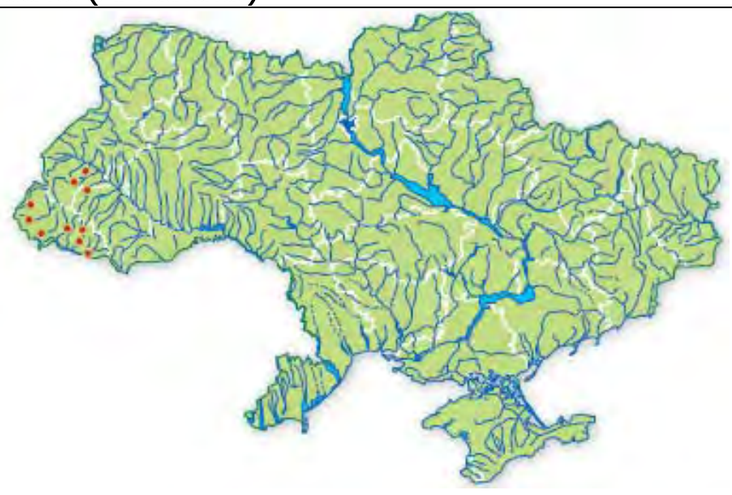
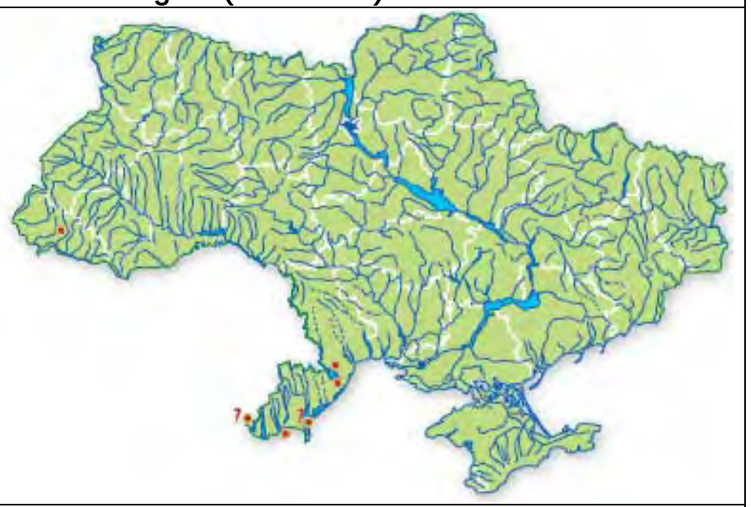
Source: Red Data Book of Ukraine, 2009

		
Carpathian brook lamprey (*Eudontomyzon danfordi*)	Ukrainian brook lamprey (*E. Mariae*)	Russian sturgeon (*Acipenser gueldenstaedii*)
		
Atlantic sturgeon (*A. sturio*)	Great sturgeon (*Huso huso*)	Black Sea salmon (*Salmo labrax*)

Key: ○ - Distribution pre 1984; ● - Distribution post 1984; ? – Likely but unconfirmed distribution; x – Fish spawning areas.

Figure 3-33: Ukraine Species Distribution Data for Red Data Book Fish (Table 1/5)

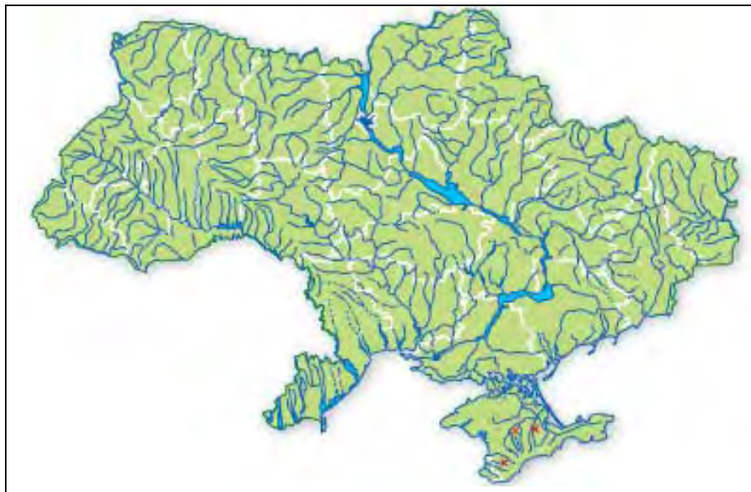
Source: Red Data Book of Ukraine, 2009

		
Ship (thorn) sturgeon (*A. nudiventris*)	Sterlet (*A. ruthenus*)	Stellate sturgeon (*A. stellatus*)
		
Danube salmon (*Hucho hucho*)	Grayling (*Thymallus thymallus*)	Mud minnow (*Umbra krameri*)

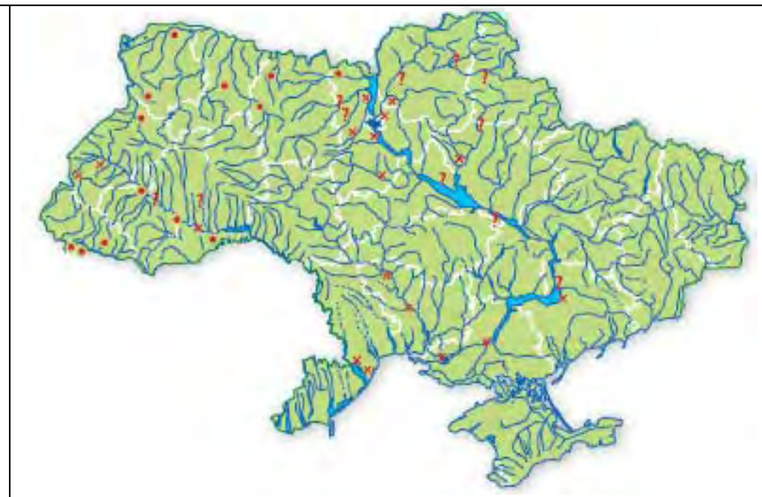
Key: ○ - Distribution pre 1984; ● - Distribution post 1984; ? – Likely but unconfirmed distribution; x – Fish spawning areas.

Figure 3-34: Ukraine Species Distribution Data for Red Data Book Fish (Table 2/5)

Source: Red Data Book of Ukraine, 2009

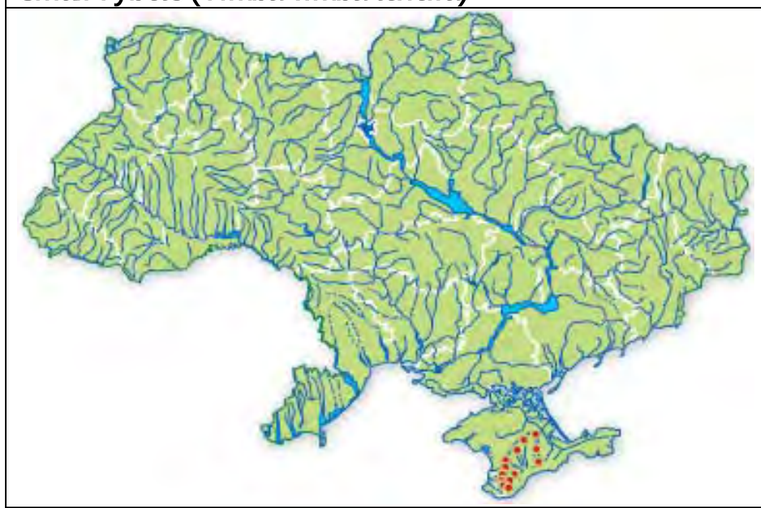


Small rybets (*Vimba vimba tenella*)

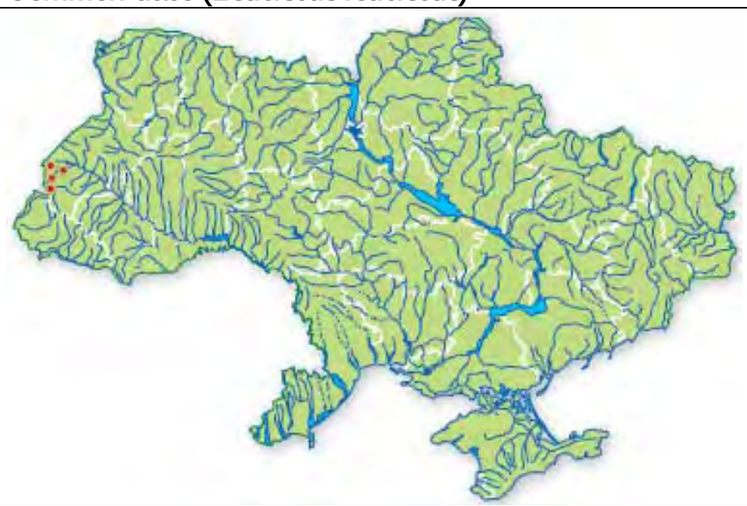


Common dace (*Leuciscus leuciscus*)

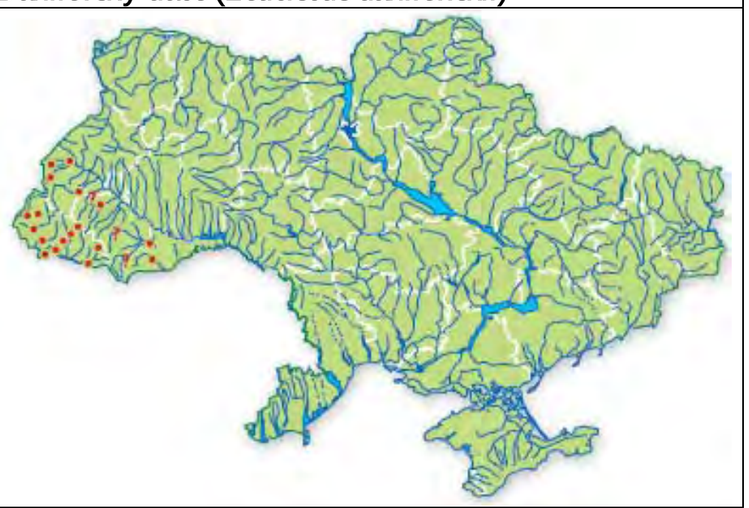
Danilevsky dace (*Leuciscus danilewskii*)



Crimean madder (*Barbus tauricus*)



Valetskoho madder (*B. waleckii*)

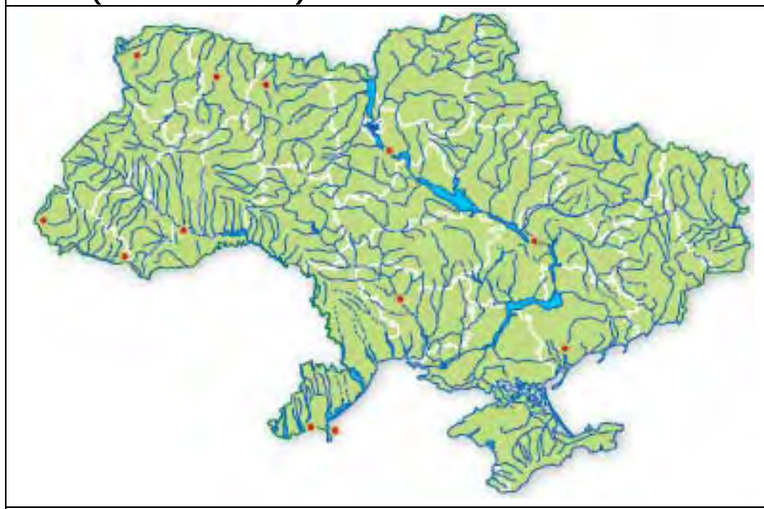


Danube-Dnestr madder (*B. petenyi*)

Key: ○ - Distribution pre 1984; ● - Distribution post 1984; ? – Likely but unconfirmed distribution; x – Fish spawning areas.

Figure 3-35: Ukraine Species Distribution Data for Red Data Book Fish (Table 3/5)

Source: Red Data Book of Ukraine, 2009

		
Dace (*Telestes souffia*)	Black Sea kutum (*Rutilus frisii*)	Volga pidust (*Chondrostoma variabile*)
		
Crucian goldfish (*Carassius carassius*)	Siberian pincher (*Cobitis melanoleuca*)	River minh (*Lota lota*)

Key: ○ - Distribution pre 1984; ● - Distribution post 1984; ? – Likely but unconfirmed distribution; x – Fish spawning areas.

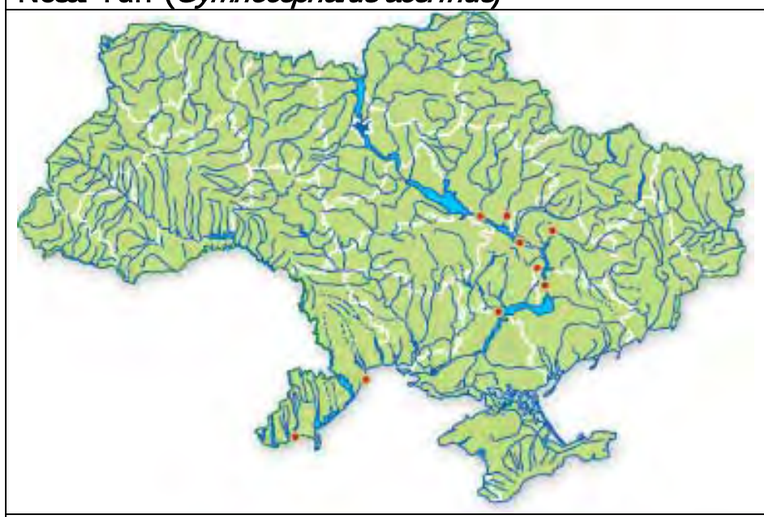
Figure 3-36: Ukraine Species Distribution Data for Red Data Book Fish (Table 4/5)

Source: Red Data Book of Ukraine, 2009

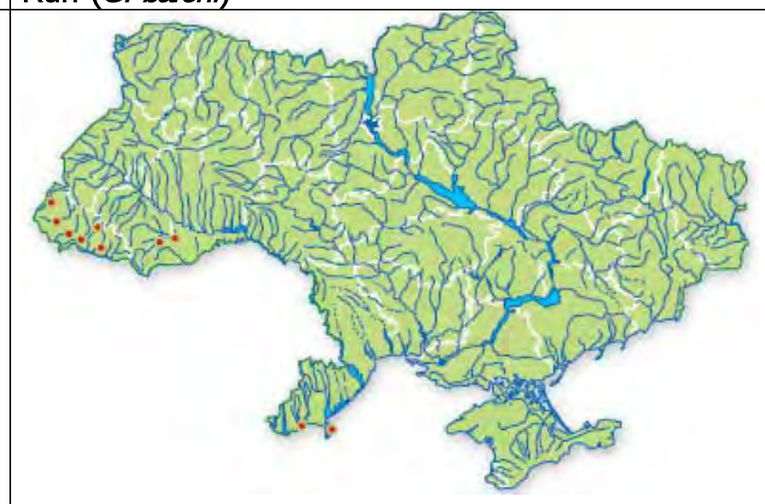
Nosar ruff (*Gymnocephalus acerinus*)

Ruff (*G. baloni*)

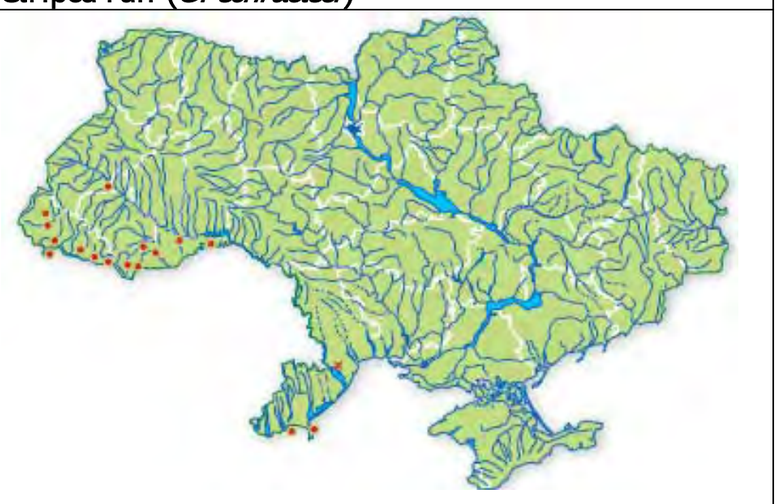
Striped ruff (*G. schraetser*)



Volga zander (Sander volgensis)



Streber (Zingel streber)



Zingel (Z. Zingel)

Key: ○ - Distribution pre 1984; ● - Distribution post 1984; ? – Likely but unconfirmed distribution; x – Fish spawning areas.

Figure 3-37: Ukraine Species Distribution Data for Red Data Book Fish (Table 5/5)

Source: Red Data Book of Ukraine, 2009

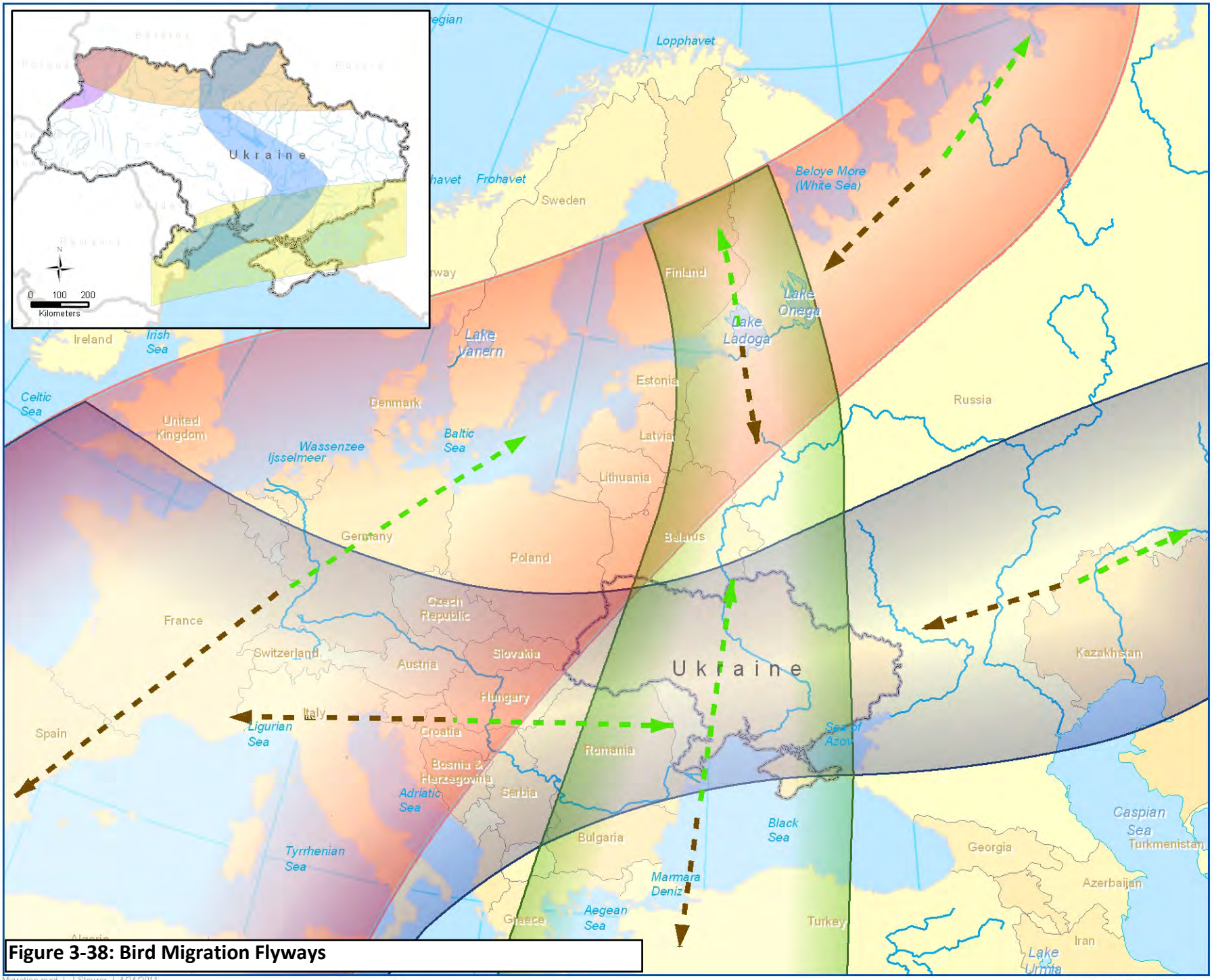


Figure 3-38: Bird Migration Flyways

Migration.mxd | J.Steurer | 4/24/2011

Data source(s): ESRI, World Database on Protected Places, CIAT-CSI (http://srtm.csi.cgiar.org), PVGIS

3.6 Community and Socio-economics

(a) Community and Socio-economics Summary of Existing Baseline

Population

The population of Ukraine is 45.8 million (data on December 1, 2010). The end of the 20th century and beginning of the 21st for Ukraine are characterised by a process of depopulation and aging. Population size declined by 7.5% in the period 1991-2001 and by 5.1% in the 2001-2010 period. The aging population of Ukraine causes social and economic problems and misbalances the population structure. This is especially an issue amongst rural populations within central Ukraine and Donbas. The demographic pressure on the working-age population is higher for rural populations. There are 792 retired people for every 1000 rural persons of working-age, compared to 592 retirees for every 1000 for urban working-age people, reflecting the higher proportion of children and retirees in the villages.

Ukraine is a multicultural country. Three quarters of the population are Ukrainian. There are particularly high numbers of ethnic Russians, with the remainder of the population principally consisting of Bulgarian, Slovakian, Polish and Czech ethnic groups with Ukrainian citizenship. However, there are strong regional variations in ethnic populations across Ukraine. For example, 12% of the Crimea population is Crimean Tatars, 12.1% of the Zakarpattia oblast population is ethnic Hungarian, and 12.5% of the Chernivtsi oblasts population is ethnic Romanian. There are also notable populations of ethnic Moldovans, Belarusians, and Romanians in oblasts bordering on these specific countries. There are populations of ethnicities including Georgians, Armenians, Azerbaijanis, Germans, Roma (Gypsy), Jews and Greeks in major cities and port areas[64].

The emigration process in Ukraine is still intensive. The average level of labour emigration is 2-2.7 million persons; most of these are persons with vocational technical training or higher education and 20-49 years old. The main emigration directions are toward Russia (40-50%), Poland (15-20%), Czech Republic (10-12%) and Italy (10%).

There was outmigration of many ethnic minorities after 1991, but also in-migration of ethnic groups who had been forcibly relocated during the Soviet era, specifically large numbers of ethnic Tatars returning from Uzbekistan, and many from the former Soviet states seeking education and employment opportunities in industrial centres.

Population density on January 1, 2010 was 76.1 persons per km^2. Density varies

[64] State Statistics Committee of Ukraine, 2010 (http://www.ukrstat.gov.ua/);

significantly from region to region (see Figure 3-39). Major urban populations are around Kyiv, Kharkiv, Odessa and Southern Crimea. Other more densely populated areas include the central-eastern part of Ukraine around Dnipropetrovsk, Zaporizhia, Donetsk and Luhansk (all major cities in their own right) and western Carpathia. Population density is reflected by the industrial hubs of the eastern oblasts, specifically Kyiv, Donetsk, Dnipropterovsk, Odessa, and Zaporizhia. The highest rates of populations living in urban areas are in the oblasts of Donetsk – 90.5%, Luhansk 86.7% and Dnipropetrovsk 83.5%. The lowest%age of urban populations are in the oblasts of: Zakarpattia– 37.2%, Chernivitsi – 41.9%, and Ivano- Frankivsk 43.2% [65].

The birth rate in Ukraine is low on average at 11.1 births per 1,000 people. However there is some variation in this with notably high birth rates in Rivne at 15.2/1000, Volyn at 14.8/1000, and Zakarpattia at 14.6/1000. Birth rates are very low in Sumy at 9.1/1000, Luhansk at 9.3/1000, and Chernihiv at 9.4/1000. The death rate in Ukraine is 15.3/1000, with the highest in Chernihiv at 19.9/1000, Sumy at 18/1000, and Poltava at 17.8/1000. The lowest death rates are in Zakarpattiaat at 12.5/1000, and Ivano- Frankivsk and L'viv both at 12.9/1000[66]. The natural change in population size in Ukraine is -4.2/1000, which will have significant impacts on future development scenarios within the next 30 years. The natural population growth rate is only positive in Rivne, Volyn and Zakarpattia. It is as low as -10.5 in Chernihiv.

Life expectancy shows a little variation across the oblasts, but on average it is 10.9 years below EU member states. Notably, women's life expectancy is 11 years longer than men, due to high rates of alcoholism and heart disease exacerbated by smoking amongst men. In Ukraine, heart disease is the leading cause of death; it is a leading cause in two of every three deaths. There is little variation across the regions in relation to heart disease[67]. Respiratory diseases account for a much lower number of deaths but the overall death rates are almost double the national average in Volyn and Cherkasy largely due to the disproportionate elderly population in these areas. Death rates are half the national average in Kharkiv. Death from tumours varies significantly from the national average, with Donetsk, Zaporizhia and Kirovohad 15-25% higher than average, and Rivne and Zakarpattia 18% and 30% lower than the norm, respectively[68]. The higher tumour/cancer rates occur in the most industrialised areas whereas the lower rates are in the least industrialised areas. Another key indicator of environmental impacts on human health is infant mortality, which is

[65] State Statistical Committee of Ukraine (2010) *Ukraine in Figures 2009 Statistical Publication*, Kyiv (p.20 Table 1.4, Total area and present population, by region)

[66] State Statistical Committee of Ukraine (2010) *Ukraine in Figures in 2009 Basic Geopolitical And Economic Characteristics*, Kyiv (Table 13.6 Vital statistics in 2009, by region, p. 178)

[67] State Statistics Committee of Ukraine (2010*) Statistical Yearbook of Ukraine for 2009*, Kyiv Table 16.19 Death rates by major cause of death in 2009, by region, p.347

[68] *ibid.*

highest in the eastern, mostly industrialised areas.

		
An unused Tatar settlement south of Simferopol, Crimea.	View of small farm community with Carpathian Mountains in background.	Skiing development in the Carpathian region prior to the ski season.

Areas impacted by the Chernobyl disaster have slightly higher rates of tumours/cancer than national averages, but it cannot be clearly attributed to the nuclear accident there according to epidemiologists. The health impacts of the Chernobyl nuclear power plant accident in 1986 have been largely mitigated in the more than 20 years after the disaster occurred. Fast responses including mass evacuations and establishment of a sterilised zone limited the long-term impacts (see Figure 3-14). According to the interagency organisation tasked with studying the impacts, it is not possible to clearly determine if there are higher rates of cancer now as a result of exposure among the most exposed populations than among the general populations.[69] Other more direct and lingering socio-economic impacts of the Chernobyl nuclear power plant accident include loss of social cohesion among resettled communities, loss of access to farm lands and loss of access to natural resources in the exclusion zone.

The overall rate of illness is increasing; respiratory organ diseases, injuries and intoxications are wide-spread causes of sickness. There are approximately 1.4% of adults with AIDS in Ukraine; 48 AIDS-related deaths occur every day. Unfortunately, Ukraine has no effective AIDS mitigation programme. Current activities are oriented towards overcoming consequences of AIDS rather than on prevention and treatment. Tuberculosis occurrence in Ukraine is one of the highest in Europe, and growing, despite significant governmental effort to combat the disease. The change in access to healthcare in the post-Soviet era, combined with increasing costs, an aging population, and newer illnesses such as HIV/AIDS has put additional strains on the population.

Transport, financial activity, and mining operations are the economic activities with a high level of remuneration of labour (salaries are 1.5-3 times higher than the average level). The lowest salaries are paid in Thernopil, Volyn, Chernigiv and

[69] The Chernobyl Forum: 2003-2005 Chernobyl's Legacy: Health, Environmental and Socio-Economic Impacts and Recommendations to the Governments of Belarus, the Russian Federation and Ukraine, p.8 at http://www.iaea.org/Publications/Booklets/Chernobyl/chernobyl.pdf, Accessed 14 April 2011

Kherson oblasts. The highest salaries are in the dormitory settlements near nuclear power plants such as Enerhodar, Kuznetsovs' Netishyn, and Yuznoukrainsk. Income disparity between the wealthy and poor continues to increase with privatisation.

There is wide variation in the earnings of the oblasts as measured by Gross Regional Productivity (GRP) Ukrainian Hrivna (UAH) per capita (see Figure 3-40). The national GDP/capita is 20,495 UAH. The highest rates are 30,918 UAH in Dnipropetrovsk and 26,028 UAH in Donetsk. In comparison, in Chernivtsi the GRP/capita is 9,771 UAH and 9,688 UAH in Ternopil[70]. These discrepancies cannot be explained by the number of pensioners and youth, who are not viewed as contributing directly to production. Rather, levels of industrialisation and the high emphasis on heavy industry production earnings are likely to be the cause. Nonetheless this indicates a significant variation in the standard of living among Ukrainian oblasts and uneven development trends nationwide.

Levels of unemployment are highest in the central and northern regions of Ukraine (excluding Kyiv). The situation in the southern, western and eastern regions is slightly better and relatively stable. It is accepted that the central northern part of Ukraine cannot achieve the economical stabilisation and growth without targeted governmental help. Population employment information is difficult to untangle, as the number of registered unemployed does not accurately reflect those not working and looking for work. There are strict regulations on those who can be listed as "registered unemployed", which may lead to potentially significant misinterpretations from the existing statistics. The lowest official figures for official unemployment are in the large cities of Odessa, Kyiv, Kharkiv, Dnipropetrovsk, Zaporizh, Donetsk, and L'viv[71]. In rural areas, potential workers who do not qualify as "registered unemployed" would add to the rates of official unemployment. In oblasts bordering the EU states, increases in employment result from international corporations establishing subsidiaries that take advantage of lower Ukrainian labour costs. Also in Carpathia and Crimea the tourism industry increases employment opportunities for local populations.

Industry

The economy of Ukraine is largely centred around the agricultural central oblasts and the industrial oblasts of the east (see Figure 3-41 and Figure 3-42). Heavy industry, mining and development focuses on the oblasts that are near the Dnieper River and the Azov Sea, while the agricultural areas range from industrial

[70] State Statistics Committee of Ukraine (2010) *Statistical Yearbook of Ukraine for 2009*, Kyiv Table 2.11 Per capita gross regional product p.49

[71] State Statistics Committee of Ukraine (2010) *Statistical Yearbook of Ukraine for 2009*, Kyiv Table 17.19 ILO unemployment, by region, p.363

agriculture (large scale production) in the central oblasts and small share farming in the east. There are significant income discrepancies between these regions due to lower wages and fewer workers in the industrial agricultural sector, and the higher wages for industrial sector employment with higher labour concentrations.

With the growth in privatisation that has occurred since 1991, there is an increasing disparity of income, with an increase in wealth of a concentrated group, while the majority of the population has seen a decline in comparative wealth. A significant amount of privatisation has occurred in Kyiv, Donetsk, L'viv, Dnipropterovsk, and Kharkiv.

40% of GDP is produced by the five oblasts of Kyiv, Donetsk, Dnipropterovsk, Odessa, and Zaporizhia. These five also share 59% of foreign direct investment. This investment trend continues to increase disparities between these oblasts and those that are lagging behind in development.

Industry accounts for half of the GDP for Ukraine, and employs 27.7% of the population. This includes metallurgy, the food industry and machinery engineering. The metallurgy industry accounts for significant investments and production in Ukraine, with food industry and machine industry making significant contributions but lagging behind in terms of overall economic development.

Ukraine provides significant amounts of ferrous metals for world markets with a well-developed coal and iron extraction and steel industry. The global market demand for ferrous materials has sustained this industry, and will likely continue to play an important role into the future. The metallurgy industry has been strong for over a century in Ukraine due to natural occurrences of coal and metal bearing ores such as ferrous and manganese, ores of rare metals such as titanium and zirconium, and non-ferrous metals such as nickel, bauxite, and mercury. Uranium ore is extracted in central Ukraine at sites in Zhovti Vody, Vatutine, Michurins'k and Novokostiantynivs'k. There are also deposits of gold; much of these are concentrated in the Dnieper basin. The manufacture of ferrous metals includes coke making, pig iron, steel, and rolled steel. These are concentrated in Dnirpropetrovsk, Donestsk, Zaproizhzhia and Luhansk. There is a need to modernise the manufacture processes to increase efficiency and reduce harm to the environment.

While overall agricultural outputs have declined, Ukraine continues to play an important role in providing cereals, beet sugar, meat and milk products to the former Soviet states, especially Russia, as well as to China and the Middle East. The potential disruptions to global agricultural markets due to climate change may increase the viability of these markets; especially as newer more efficient production measures are introduced. The food industry accounts for 13.4% of total employment, and 16.3% of total GDP. It is concentrated, as an industry, in

Vinnytsia, Kharkiv, Kyiv, and Sumy oblasts.

The machine industry has been well developed historically and has potential to develop further as a priority for the national economy. The subsectors are: power generation machinery including turbines; vehicle engineering for trains, shipping, aircraft, lorries and buses; aircraft construction; space and rocket technology; and, the motor industry including cars and lorries. The chemicals industry draws on rich natural resources and includes potash salts mined in Ivano-Frankivsk and L'viv, rock salts mined in Zakarpattia, and sulphur in L'viv. There are also mineral fertilisers located with coke and coal processing, phosphorus production from imported raw materials, and soda manufacturing from rock salt deposits, limestone quarries and fuel sources. Caustic soda and chlorine are produced in the Ivano-Frankivsk oblast. Other chemicals industries include paint and varnish manufacture, plastics, and petrochemicals.

The agricultural potential of Ukraine is currently unrealised. Formerly the "breadbasket" to the Soviet Union, the subsequent division between industrial farming and household plots is notable. In the west, more than 80% of agricultural production comes from household plots in Rivnre, Volhniya, L'viv Zakarpattia, Ivan Franks'k, and Chernivtsi, which is labour intensive but the production rates are 1,000-2,000 UAH million. In comparison, household production is 3,000 – 5,000 UAH million in Kyiv, Kharkiv, Donetsk and Dnipropetrovsk, where household production accounts for less than 50% of production. Agricultural production focuses on cereals, industrial crops, potatoes and vegetables. Animal husbandry for meat and milk production and poultry has declined, since 1990, however it remains steady. Livestock breeding in the more mountainous regions is especially common because the land is not suitable for crop production[72].

The transportation infrastructure in Ukraine focuses on industrial areas for rail, road, port and airfields (see Figure 3-43). These are primarily in the western region and around Kyiv. Also well served is Odessa and hubs for rail, road and air in Chernivtsa, Ivano Frankivsk, L'viv and Rivne. Transport of coal, ores, ferrous metals, and raw materials make up most goods transported by rail. Transportation on domestic waterways is low in comparison to other means of transport and primarily for domestic markets. Cargo through seaports is approximately 50% exports, and 38% goods in transit.

The energy sector in Ukraine includes energy resources currently used, mining and transit of coal, gas and oil, electricity generation and transmission. Natural resources include coal, of which 91.5% of coal production is from the Donetsk basin, and 6% from the L'viv – Volhynian basin. There are also significant natural

[72] Institute of Geography, National Academy of Sciences of Ukraine (2009) Ukraine in Maps, Kyiv. pps. 101-108

gas reserves that are largely untapped to date. Oil and gas are concentrated in the Dnipro-Donts, Carpathian and Black Sea-Crimea regions. Historically Ukraine has been dependent on Russia for oil and natural gas, and largely remains so. Ukraine serves as a conduit for significant oil and natural gas from Russia and the Caspian basin, with a series of natural gas and oil pipelines transecting Ukraine (see Figure 3-43). Shifts in policies in Russia related to the sale price of natural gas have impacted Ukraine, which has sought to diversify the supply.

Electricity generation in Ukraine is split between thermal power plants (64% of the energy generation) and nuclear (26% of the energy generation), with renewable energy accounting for the remaining energy generation. The largest power plants are concentrated in Donetsk basin and in the vicinity of Kyiv. Transmission lines were largely constructed during the Soviet era, and serve the industrialised areas predominantly, while meeting basic requirements in less industrialised areas. Soviet-era transmission lines extended regionally to Hungary, Poland, Romania and Bulgaria providing power from western Ukrainian major plants in Burshtyn, Kuznetsovs'k, Netishyn, and Yuzhnoukrains'k. The existing thermal plants need modernising to provide more efficient energy production and to reduce environmental impacts. The four nuclear power plants in Enerhodar, Yuzhnoukrains'k, Rivnensk'ka and Khmelnytskyi are also in need of updating.

Ukraine currently has significant excess power production capacity, as power generation has dropped considerably following the dissolution of the Soviet Union. A significant amount of power generation capacity is centralized in the Dnipro and Donbass Electric Power Systems. Most oblasts have excess generation capacity to export and tremendous transfer capability with neighbouring oblasts; however, the neighbouring oblasts with its own excess generation and limited load would not be able to absorb all of the exported renewable energy from its neighbours. Thus, the transfer capability is a theoretical maximum for estimating the export capacity of renewable energy from an oblast, but it is not realistic except in a few cases.

There are in fact three predominant factors constraining the capability of the Ukraine transmission grid to transfer the renewable energy which is technically feasible to generate in any given oblast or region:

- Transfer capability of the grid;
- Availability of the required renewable resource; and,
- Regional load limit (the unutilised load capacity in the immediate region that can consume the energy).

Further study has been carried out to estimate the impacts of these three constraints upon the eight electrical systems and 25 oblasts of Ukraine, with regard to on-shore wind and solar photovoltaic renewable energy scenarios. Further information is provided in full in the Technical Reports which support the SER Environmental Report.

Tourism has not yet reached its potential in Ukraine. Abundant natural and recreational amenities exist; however, this industry has been slow to develop, especially for the international market due to low investment and a perception of instability. There is tremendous tourism potential, if developed properly. Forests in Zakarpattia, Ivano-Frankivsk, Rivne and Zhytomyr are sought after for their healthy environments, as well as mushroom and berry picking opportunities. Wetlands in Rivne, Chernihiv, Volyn, and Zhytomyr would be ideal for ecotourism; hunting and fishing have been off-limits in some areas due to the Chernobyl accident. Recreation and leisure activities in surface waters including lakes and rivers in Volyn, Zakarpattia, L'viv, Rivne, Ternopil and Khmelnytskyi also have high potential. Beaches on the Black and Azov Seas, especially in the oblasts of Odessa and Crimea have been widely popular in the past and have potential for future developments. The bathing season ranges between 80 days to 120 days per year depending on the latitude. Skiing and other winter sports are popular in the Carpathian Mountains, and other mountain activities (rock climbing, alpinism, mountain hiking) are well suited for both the Carpathian and Crimean mountain ranges. Many historical tourist sites for health resorts and spas focusing on the waters of L'viv, Zakarpattia, Crimea, and Odessa, and Kharkiv, which also features unique mineral waters and muds with medicinal benefits. Hunting remains popular with 46.5 million hectares in hunting estates, employing 6600 persons, a 20% increase since 2000.

The natural resources of Ukraine are directly impacted by human activities, which in turn impact living conditions. Ukraine's heavy industrialisation prior to changes in legislation and greater environmental awareness resulted in severely impacted conditions. The use of obsolete production technologies and outdated waste treatment facilities continues to plague the natural environment. The highly industrialised oblasts of Donetsk, Dnipropetrovsk, Luhanks, and Zaporizhia are strongly impacted. Contamination of soils, air and water remain problematic, and potable water is generally scarce, though data is inconclusive pertaining to availability of drinking water. It should also be noted that export of mineral water for drinking has become important for some mountainous regions. In contrast, water body contamination is severe in the Donetsk, the Sea of Azov, and some tributaries of the Dnister, Dnipro and Waster Buh rivers.

The Chernobyl disaster in 1986 has lead to radioactive contamination over a land area of 54,000 km^2, including 25,000 km^2 of woodlands in north central Ukraine. Areas near industrial centres in Donetsk, Dnipropetrovk, Zaporizhia, Luhansk, Poltova Cherkasy, Odessa, Kyiv, Chernivtsi, and Ivano-Frankivsk are rated as "deteriorated" based on provision of potable water, water logging, and salinisation, water and air pollution, soil contamination and other human pressures on ecosystems.

(b) Community and Socio-economics Future Trends in Baseline

Aging population has caused disproportions in population structure that will not be overcome in the near future. For a long period, these tendencies were aggravated by emigration of the most economically active population and a high rate of illnesses. This leads to a discrepancy between urban and rural areas, though the overall productivity does not reflect the current number of pensioners. Rather the pressures will be placed on younger workers to support an increasingly aging population with a negative population growth rate. In areas with increasing populations as a result of natural population growth, the ethnicity of the rising populations may cause a shift in the overall population dynamic. This has potential to increase ethnic tensions and should be monitored. An example of this is the increased birth rate of ethnic Crimean Tatars in Crimea, but a decline in Ukrainian birth rates there.

Gender disproportion of working aged male adults due to outmigration for employment opportunities are likely to continue. The disproportion of pensioner aged women is due to the high rates of death associated with alcohol abuse and smoking among retired men. Elderly women are more likely to be in poverty because they are living longer than their male cohort. Current public health campaigns seek to reduce this trend, however it will likely require several generations to even out, if these campaigns are successful.

There are now some weak but positive trends observed for social and economic development. The economic growth between 2003 and 2006 stimulated job creation, demand for higher education, industrial development and progress of society. However, this process was not accompanied by technical and technological modernisation and innovation. Therefore, the current economic situation is worsening by exhaustion of growth potential while expectations and social obligations are not met. Industrial growth is not consistent across sectors, nor is it level across regions of Ukraine. Urban areas in the east, which already have industry, continue to attract labour and investment, while in the west and central areas industry has stagnated. The trend of increasing new subsidiaries in urban areas bordering EU member states takes advantage of low labour costs, and may result in some population redistribution.

The continued global demand for steel will play an important role in Ukraine's economy and trade, though investment in updating smelters to use more efficient technologies could have the benefits of improving environmental conditions and reducing waste of natural resources. The high energy demand for heavy industry favoured by Ukraine will require diversification of fuel sources and possibly development of domestic natural gas reserves. Energy efficiency for industry, commercial and domestic purposes will require improvement to remain competitive in international markets, as costs are expected to continue to rise. The 2008 -2009 global economic downturn can be seen as slowing the growth trend in Ukraine, indicating its sensitivity to global markets.

The human health situation is critical for continued economic development, by international norms – the death rate from cardiovascular disease, tumours, AIDS and tuberculosis is increasing and bears future monitoring. Loss of workers both to disease and to care-taking roles deteriorates the potential labour market. The perception of an aging, unhealthy population does not serve to attract foreign investment, despite low cost, well-educated labour.

Many have noted that climate change trends of warmer climate and abundant precipitation in Ukraine will open up a new agricultural 'frontier'. However, potential benefits are reported to be reduced in comparison to the costs of the region's relative technical inefficiency and low rates of agricultural productivity. [73]. Current supplies of cereals to Russia, the Middle East and China will play an increasingly important role, as climate change impacts food security concerns. With more modern farming methods, Ukraine could play a vital role in global food production due to anticipated changes in precipitation and temperature resulting from climate change.

The population of Ukraine is increasingly aware of environmental issues, due to the negative impact of the Chernobyl incident. This awareness can serve to increase popular support for sustainable energy projects, which could in turn be used to highlight the potential for tourism development in Ukraine. Ukraine lags in tourism industry development, in part due to lingering perceptions of the international community of environmental degradation there. As a result pro-environmental projects could assist in reversing this negative trend.

(c) Community and Socio-economics Data Sources

The following data sources were used in producing baseline text for the community and socio-economics section:

- Internet sources such as, Water Profile (http://www.eoearth.org/article/Water_profile_of_Ukraine) and Energy Profile http://www.eoearth.org/article/Energy_profile_of_Ukraine);
- "Environment of Ukraine: Statistics" (Ministry of Statistics of Ukraine: 2009);
- "Ukraine in Figures: Statistics" (Ministry of Statistics of Ukraine: 2010);
- State Statistics Committee of Ukraine, 2010 (http://www.ukrstat.gov.ua/);
- National Atlas of Ukraine, ed. by L.G. Rudenko. Available from National Academy of Sciences of Ukraine Institute of Geography, 01034 Kyiv;
- "Ukraine in Maps" Institute of Geography, National Academy of Sciences of Ukraine;

[73] World Bank Europe and Central Asia Region Sustainable Development Unit (2008) *Competitive agriculture or state control: Ukraine's response to the global food crisis.* Washington D.C. p.4

- "Statistical Publication: Regions of Ukraine, 2010, Part I" State Statistics Committee of Ukraine, 2010;
- "Statistical Publication: Regions of Ukraine, 2010, Part II" State Statistics Committee of Ukraine, 2010;
- "Ukraine in Figures in 2009" Basic Geopolitical And Economic Characteristics,. State Statistics Committee of Ukraine;
- "Millennium Development Goals, Ukraine" Ministry of Economy and European Integration of Ukraine 2003;
- "Statistical Yearbook of Ukraine for 2009" State Statistics Committee of Ukraine, 2010;
- "Competitive agriculture or state control: Ukraine's response to the global food crisis." World Bank Europe and Central Asia Region Sustainable Development Unit, 2008;
- "Eco-Nationalism: Anti-Nuclear Activism and National Identity in Russia, Lithuania, and Ukraine" Jane I. Dawson, 1996; and,
- " Chernobyl's Legacy: Health, Environmental and Socio-Economic Impacts and Recommendations to the Governments of Belarus, the Russian Federation and Ukraine" The Chernobyl Forum: 2003-2005, Second Revised Version at http://www.iaea.org/Publications/Booklets/Chernobyl/chernobyl.pdf, Accessed 14 April 2011.

(d) Community and Socio-economics Data Quality

The data quality for community and socio-economics is quite good, with consistency across sources, and a wide array of information available. The information for oblast level reflects a good knowledge of the geography of Ukraine, and there is some variation in the English translation of Ukrainian names. Information is abundant, up to date, and accessible in electronic form.

(e) Community and Socio-economics Data Gaps

The gaps in data for community and socio-economics are due to inconsistencies in data on employment/unemployment, life expectancy at birth, and about access to potable water and waste management capacity. There is also no information available on military bases or operations, due to national security issues. The existing information on unemployment does not meet International Labour Organisation (ILO) standards, as only the registered unemployed are counted. There are very strict rules about who may be registered as unemployed in Ukraine; therefore, the information does not reflect the actual situation. The existing information on life expectancy does not clearly indicate that it is life expectancy *at birth*, which is a standard for measuring current living conditions. The information on access to potable water is not readily available, and there is wide variation among sources some of which say there is greater than 80% and some say less that 10% of the population with access to potable water. Additionally there is no clearly accessible information on waste management

capacity that is standardised across oblasts.

(f) Community and Socio-economics Constraints and Opportunities of Renewable Energy

The key constraints and opportunities for renewable energy in relation to community and socio-economics are summarised in Table 3-12.

Table 3-12: constraints and opportunities in relation to community and socio-economics

Constraints	Opportunities
• Sporadic presence and condition of electricity grid and connections; • Shortage of technically qualified workers; • High emigration level that has reduced the available technically qualified workers; • Possibility of ethnic conflicts centring around land use; and, • Inefficient energy use in domestic and industrial practices.	• Increased employment opportunities; • Increased potential for worker training; • Increased environmental awareness of population and need for sustainable energy; • Increased development of advanced technology; and, • Further integration into neighbouring EU power markets.

(g) Community and Socio-economics Figures

The figures that follow have been referenced within Section 3.6 of this Topic Paper (the Community and Socio-economics baseline and future baseline text):

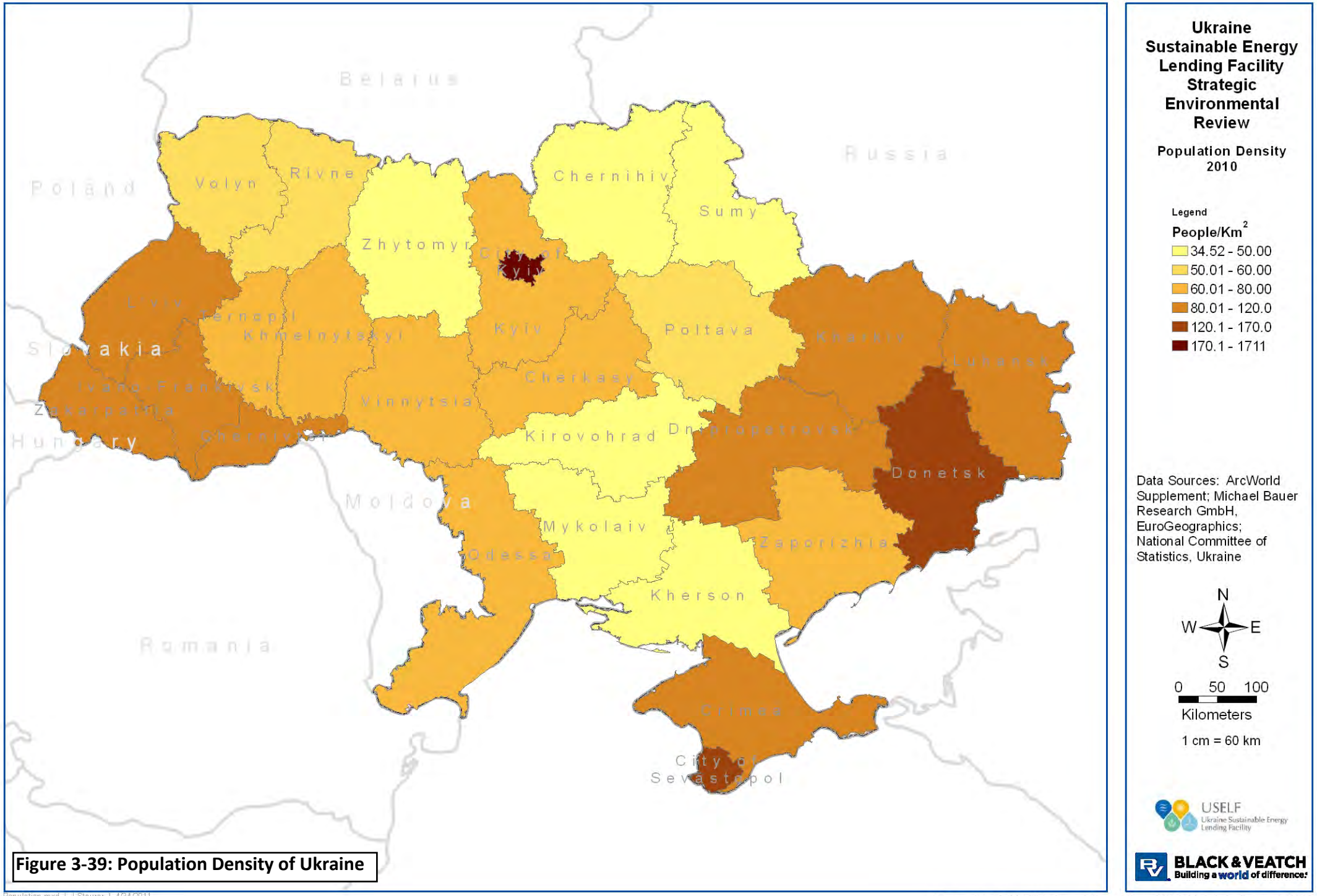


Figure 3-39: Population Density of Ukraine

Population.mxd | J.Steurer | 4/24/2011

Data source(s): ESRI, World Database on Protected Places, CIAT-CSI (http://srtm.csi.cgiar.org), PVGIS

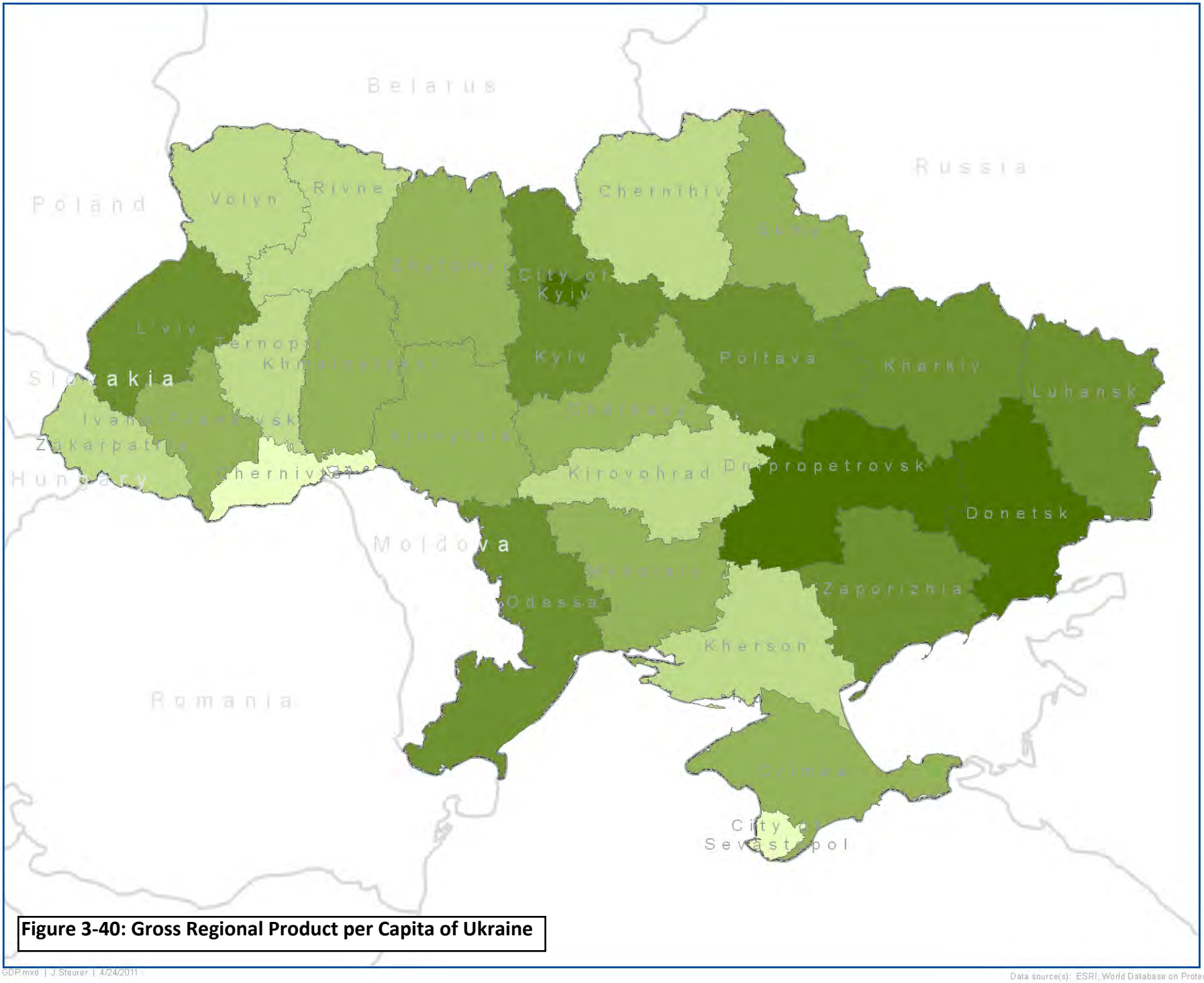


Figure 3-40: Gross Regional Product per Capita of Ukraine

Ukraine Sustainable Energy Lending Facility Strategic Environmental Review

Gross Regional Product 2008

Legend

GRP (millon UAH; adjusted to 2009 values)

- 6,305 - 10,000
- 10,001 - 15,000
- 15,001 - 30,000
- 30,001 - 60,000
- 60,001 - 169,564

Data Sources: ArcWorld Supplement; Michael Bauer Research GmbH, EuroGeographics; National Committee of Statistics, Ukraine

N
W E
S

0 50 100
Kilometers

1 cm = 60 km

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GDP.mxd | J.Steurer | 4/24/2011

Data source(s): ESRI, World Database on Protected Places, CIAT-CSI (http://srtm.csi.cgiar.org), PVGIS

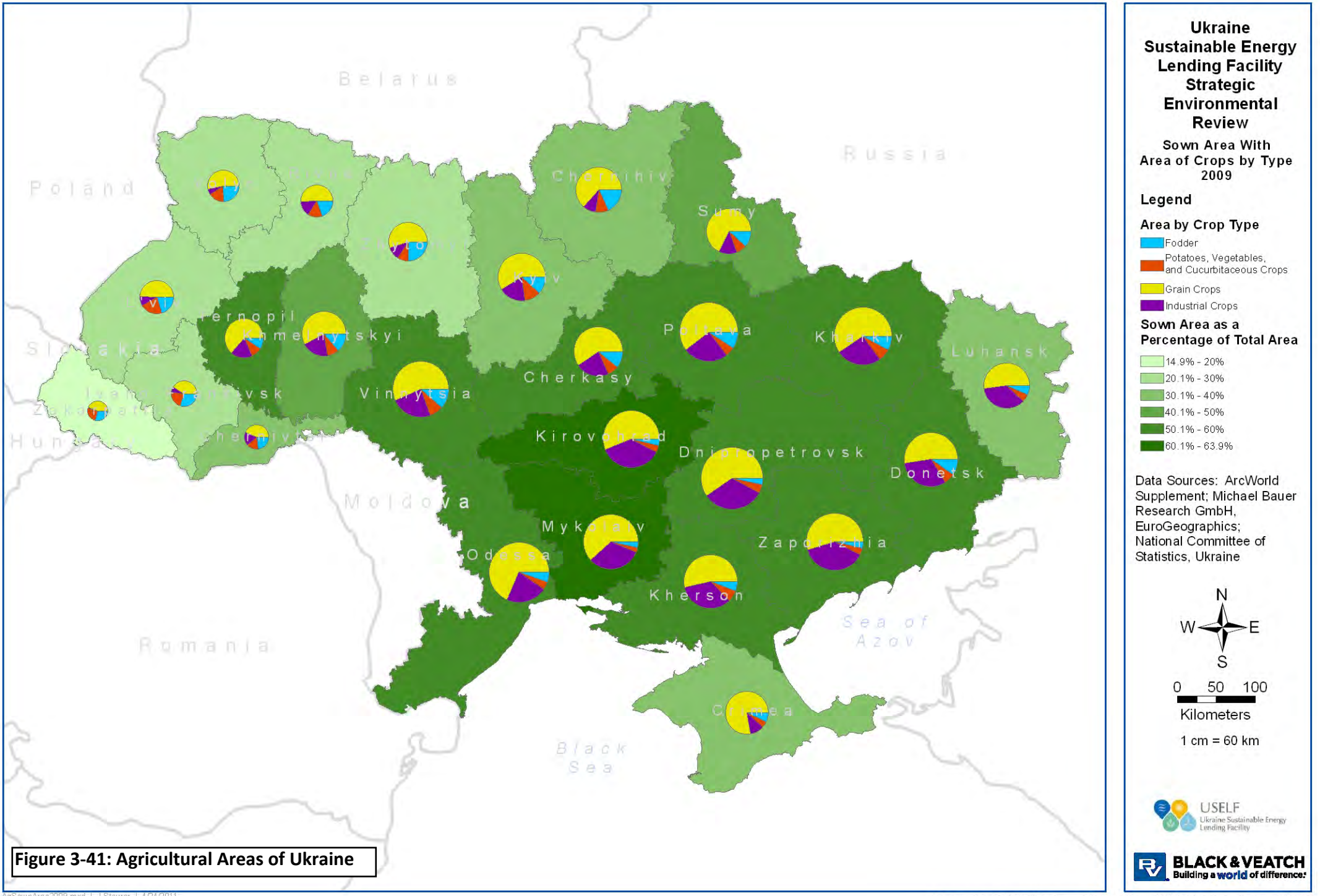
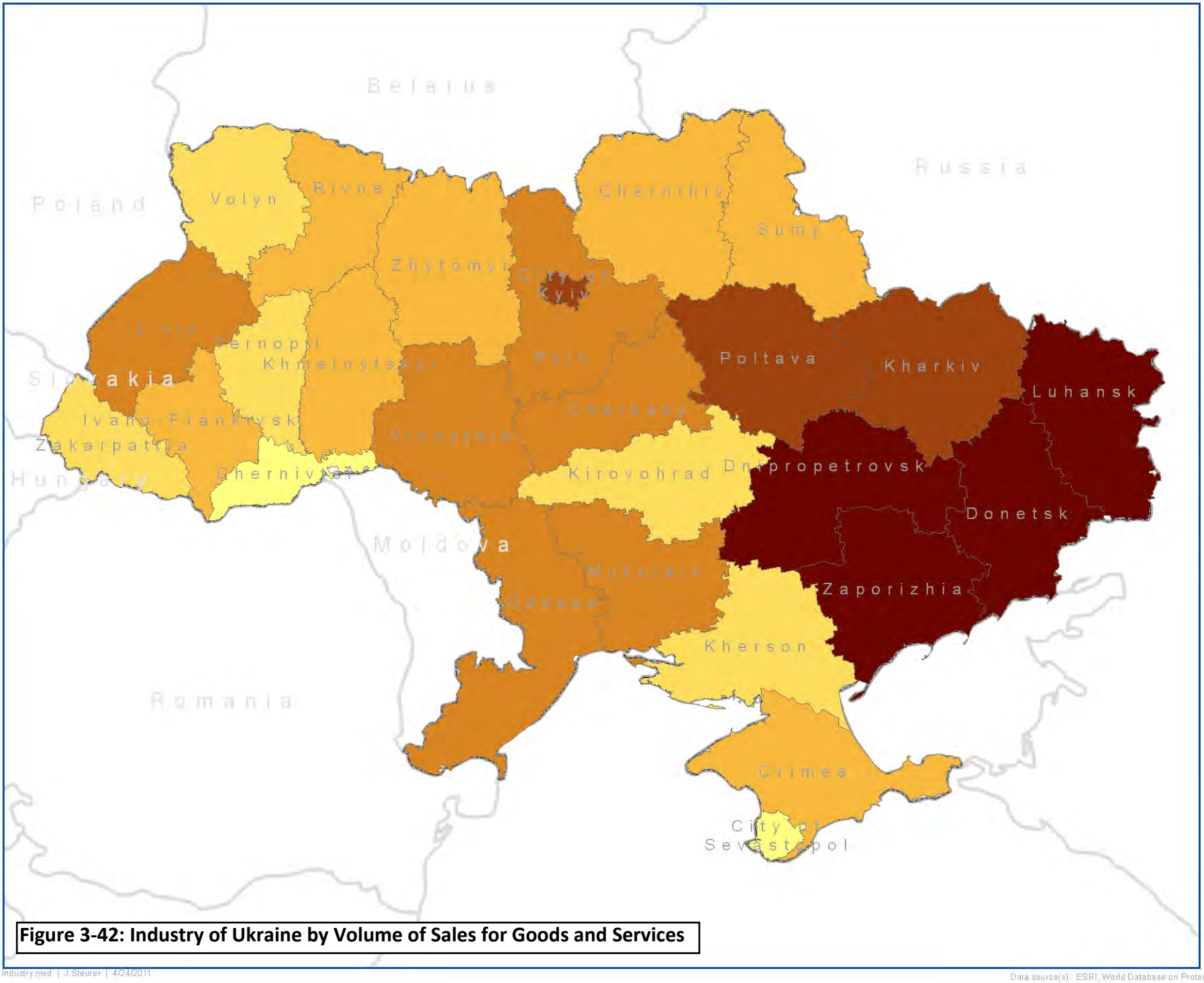


Figure 3-41: Agricultural Areas of Ukraine

AgSownArea2009.mxd | J.Steurer | 4/24/2011

Data source(s): ESRI, World Database on Protected Places, CIAT-CSI (http://srtm.csi.cgiar.org), PVGIS



Ukraine Sustainable Energy Lending Facility Strategic Environmental Review

Industry
Volume of Sales for Goods and Services 2010

Legend

Goods and Services (billion UAH)

- 2.7 - 5.0
- 5.1 - 10.0
- 10.1 - 15.0
- 15.1 - 30.0
- 30.1 - 60.0
- 60.1 - 187.4

Data Sources: ArcWorld Supplement; Michael Bauer Research GmbH, EuroGeographics; National Committee of Statistics, Ukraine

N
W E
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0 50 100
Kilometers

1 cm = 60 km

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Figure 3-42: Industry of Ukraine by Volume of Sales for Goods and Services

Industry.mxd | J.Steurer | 4/24/2011

Data source(s): ESRI, World Database on Protected Places, CIAT-CSI (http://srtm.csi.cgiar.org), PVGIS

Figure 3-43: Infrastructure of Ukraine

Infrastructure.mxd | J.Steurer | 4/24/2011

Data source(s): ESRI, World Database on Protected Places, CIAT-CSI (http://srtm.csi.cgiar.org), PVGIS

3.7 Cultural Heritage

Cultural heritage can be defined as a group of resources inherited from the past with which people can identify independent of ownership, and as a reflection and expression of their constantly evolving values, beliefs, knowledge and traditions. Cultural heritage encompasses tangible or physical aspects such as sites, structures, features and landscapes that have archaeological, palaeontological, historical, architectural, religious, aesthetic other cultural significance. It also encompasses intangible aspects such as practices, representations, expressions, knowledge, skills as well as associated objects, artefacts and cultural spaces that are transmitted from generation to generation.

(a) Cultural Heritage Summary of Existing Baseline

Prehistory

Archaeological traces of humans in the territory which is modern day Ukraine date back many thousands of years. Traces of human habitation date back 30,000 years to when the ice started to retreat at the end of the Quaternary (last ice age). Palaeolithic sites have been found along the shores of the Black Sea, and the Dnieper and Dniester Rivers. Archaeological finds from the Palaeolithic (Early Stone Age) and Mesolithic (Middle Stone Age) include primitive stone tools, carvings from mammoth tusks, and arrow heads made from flint stone.

Ukraine has been continuously settled since at least 5,000 BC, although this was a mixture of some sedentary settlements and agriculture and nomadic pastoralism.

The late Neolithic Cucuteni-Trypillian culture flourished from about 5000–3000 BC from the Carpathian Mountains to the Dniester and Dnieper regions (see Figure 3-44). Settlements of the Cucuteni-Trypillian culture were often burned every 60-80 years and then rebuilt, with sites showing layers of continuous occupation. Archaeological evidence suggests that inhabitants practiced agriculture, raised domestic livestock, and hunted wild animals. During the Copper Age people of the Cucuteni-Trypillian culture resided in the western part of Ukraine, and the Sredny Stog culture (4500-3500) further east, situated just north of the Sea of Azov between the Dnieper and the Don Rivers. The Sredney Stog culture is associated with some settlements and burials as well as artefacts such as pottery and stone battle axes, in addition to some of the earliest evidence for domestication of the horse (e.g. Dereivka in Kirovohrad oblast on the right bank of the Dneiper).

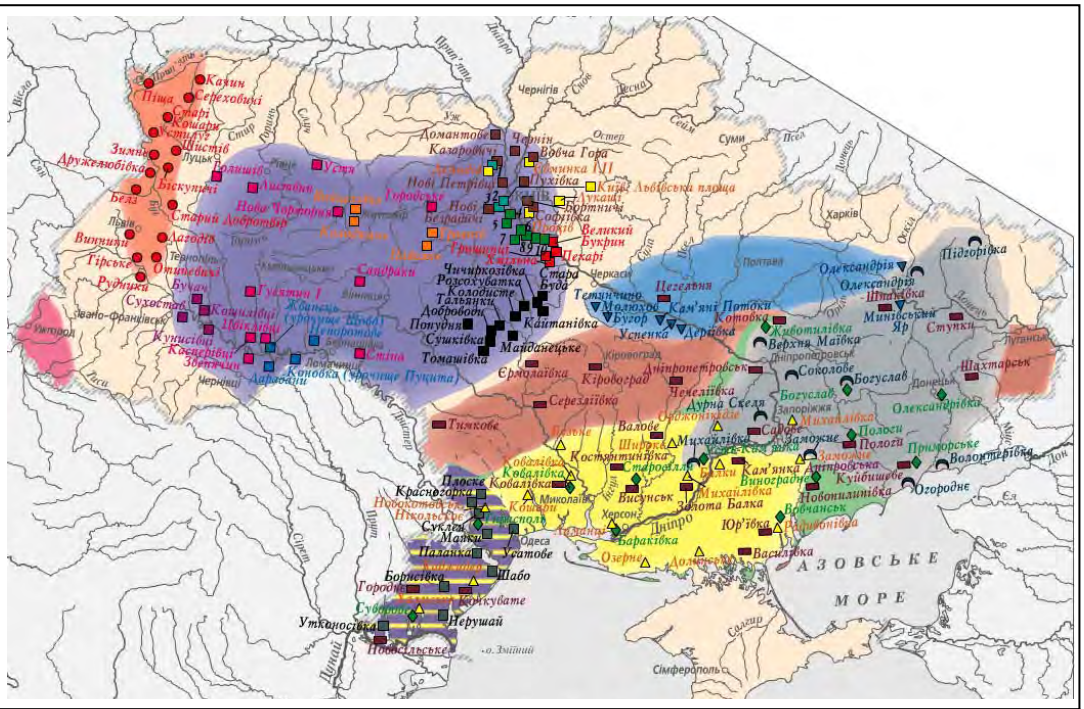


Figure 3-44: Settlements and cultures in the Aeneaolithic (second half of the 4th – early 3rd Millennium).

The broad areas of colouring, symbols and coloured squares represent the Cucuteni-Trypillian Culture and related cultures, locations and groups respectively.

The Cucuteni-Trypillian culture was succeeded by the early Bronze Age Yamna culture (3600-2300 BC) (also known as Pit Grave culture in English) of the steppes. The Yamna culture was predominantly nomadic, with a few hillforts and some agriculture practiced near rivers. It was associated with inhumations (burials) in kurgans (or tumuli) in pit graves.

About 300 stone stelae or 'stone babas' as they are known in Ukrainian, date from the 4th Century BC, and are often associated with burials and are found within the Crimea and adjacent steppe region. Most of them are very crude stone slabs with a simple schematic protruding from the head and a few features such as eyes or breasts carved into the stone.

Early Civilisations

The Iron Age in Ukraine was represented by Indo-European, horse riding, nomadic cultures, some of which practised agriculture. These cultures largely occupied the steppes and forest-steppes and included the Dacians (occupying parts of Sarmatia, mostly in eastern Ukraine); Cimmerians (north of the Black Sea); Scythians (South-central Ukraine and Crimea, 750-250BC) and Sarmatians (Western Ukraine, 250BC – 250AD). Archaeological evidence includes kurgan tombs, sometimes with elaborate grave goods, and some settlement.

Excavations of an extensive (40ha) fortified settlement at Bilske Horodyshche near the village of Belsk, near Poltava, have suggested the site is the Scythian capital of Gelonus[74].

At the same time, around the 6th century BC, the Ancient Greeks colonised the shores of the Black Sea, trading wine, oil, and textiles, silver and gold wares. Sites include colonies of Tyras (at the mouth of the Dneister River, covered by the medieval fortress of Monocastro), Olbia (on the mouth of the Bug), and Kerkinitis, Theodosia and Chersonesos in Crimea (see Figure 3-45). Many of these settlements persisted until Roman times.

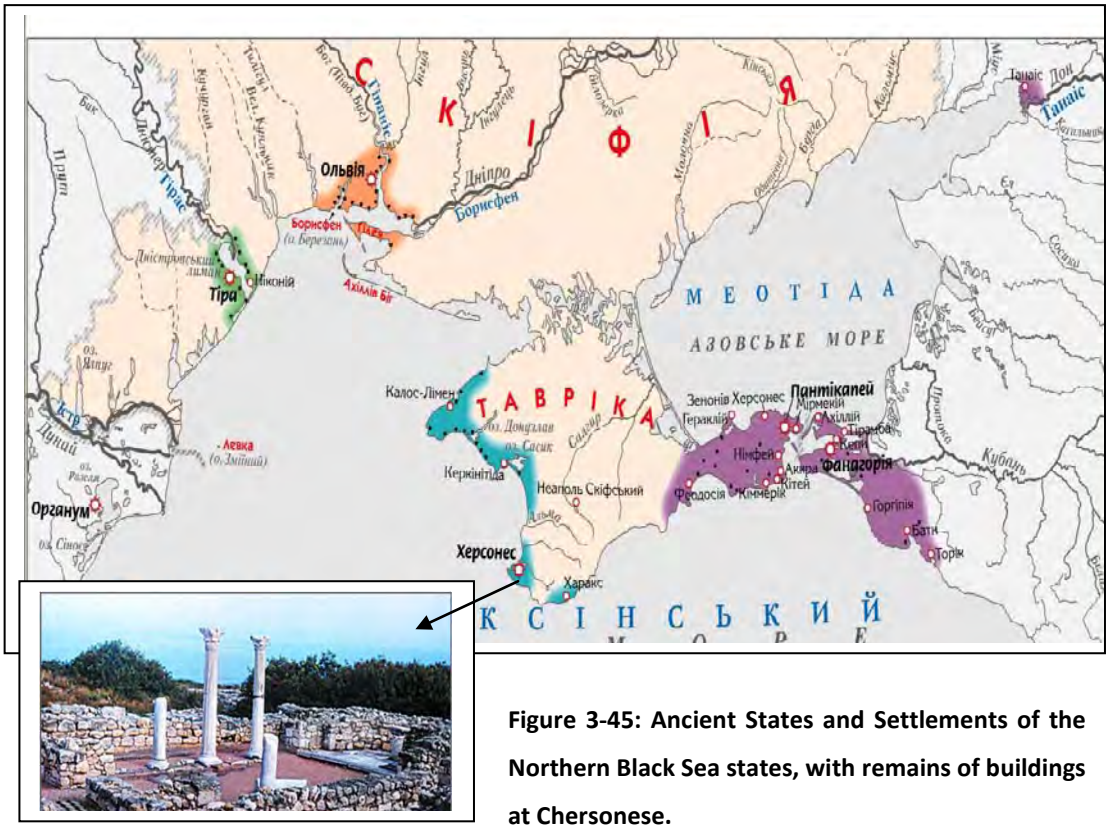


Figure 3-45: Ancient States and Settlements of the Northern Black Sea states, with remains of buildings at Chersonese.

Source: Buyskyh, S.B., in National Atlas of Ukraine)

The Goths, and Eastern Germanic tribe migrated from an area corresponding to present day Poland to Ukraine around 250–375 AD, concentrated mainly in the southwest. This migration, along with local population, formed the new Chernyakhov culture (second – late fourth Century AD), named after the archaeological site at the village of Cherniakhiv in Ukraine's Kyiv oblast. The culture is typified by settlements on open ground in river valleys, consisting of sunken huts arranged in parallel. Both inhumation and cremation were practiced.

[74] by Boris Shramko, noteable Ukrainian historian

Grave goods include pottery, iron implements, bone combs and personal ornaments. To the north of the Chernyakhov culture, the Kyiv culture co-existed, evidenced by small villages along river banks.

About 370 AD, the first Asian horde of Huns, on their way to western Europe, defeated and expelled Goths from much of Ukraine. However, a group known as the Ostrogoths stayed in the Crimean Peninsula, with their mountain stronghold at Doros, 20km east of Chersonesus (near modern day Sevastopol). The Ukrainian hinterland north of the Black Sea was subject to further invasions from the Kutrigurs and Utrigurs in the fifth century, the Avars in the sixth century, and the Bulgars in the seventh century. In the meantime the coastal region along the Black Sea, including the cities of Tyras and Olbia, experienced relative stability under the influence of the Byzantine Empire. The Roman influence brought with it Christianity, and Chersonesus on the Crimea became an important centre, surviving evidence includes St Peter's basilica in Kruze and a monastery built in a cave along cliffs at nearby Inkerman.

Slavic Culture, the Khazars and Kyivan Rus

With the power vacuum created with the end of Hunnic and Gothic rule, Slavic tribes, possibly emerging from the remnants of the Kyiv culture, began to expand over much of the territory that is now Ukraine during the fifth century, and occupied an area between the Dniester and the Dnieper Rivers during the sixth and seventh centuries. Slavs used available hilltops to build protective fortresses, Kyiv was formed approximately 560 AD between three such hilltops.

In the seventh century, the territory of modern Ukraine along the Black Sea and Crimean Peninsula, south of the Slavs, was the core of the state of the Bulgars (often referred to as Old Great Bulgaria) with its capital city of Phanagoria. By the end of the seventh century, most Bulgar tribes migrated in several directions and the remains of their state were absorbed by the Khazars, a semi-nomadic people from Central Asia. Then followed two centuries, from the mid-seventh to the mid-ninth century, of stability from invasions from elsewhere in Europe and Asia. Sedentary people, including the Slavs within the Khazak Empire and to the Northeast, were able to develop.

In 882, Kyiv was conquered from the Khazars by the Varangians, who were originally a Scandinavian warrior-elite that came to rule over, and alongside, a majority of Slavic subjects. Kyivan Rus', incorporating modern day Ukraine and extending north to the Baltic Sea, became a powerful Slavic state situated on prosperous trade routes.

A successor state to Kyivan Rus' on part of the territory of today's western Ukraine was the principality of Galicia-Volhynia including the cities of Halych and Ladomir (later Volodimer).

Mongol raids into Rus' Kyiv began in the 12th and 13th centuries and all principalities fell under Mongol dependence. In 1240 Kyiv was sacked.

Lithuania, Poland and Russia

During the 14th century, Poland and Lithuania fought wars against the Mongol invaders, and most of the territory of what is modern Ukraine was annexed between the two. Poland took the south-west, including Galicia, and Lithuania ruled the lands in the north and north-west, including the region round Kyiv. During that time, Ukrainians began to conceive of themselves as a distinct people, a feeling that survived subsequent partitioning by greater powers over the next centuries. After the formation of the Polish-Lithuanian Commonwealth in 1567, Ukraine fell under Polish administration. The period immediately following the creation of the Commonwealth saw a huge revitalisation in colonisation efforts with many new cities and villages being founded.

Ukrainian peasants who fled the Polish effort to force them into servitude came to be known as Cossacks and earned a reputation for their fierce martial spirit and love of freedom. The 1648 Ukrainian Cossack (Kozak) rebellion and war of independence (Khmelnytsky Uprising) started an era of fighting which undermined the foundations and stability of the Polish-Lithuanian Commonwealth. In 1667, Ukraine was partitioned between Poland and Russia. Under Russia, the Cossacks initially retained official autonomy in the Hetmanate. For a time, they also maintained a semi-independent republic in Zaporozhia, and a colony on the Russian frontier in Sloboda Ukraine.

In 1793, when Poland was partitioned, much of modern-day Ukraine was integrated into the Russian Empire, with the exception of the west of Ukraine which was controlled by the Austrians. Both Russia and Austria tried to limit the rise of Ukrainian cultural and linguistic traditions. The Russian controlled part of Ukraine at least, saw the rise of the arts, including architecture.

Modern History

Modern history in Ukraine is largely linked to Soviet control and military history.

When World War I broke out, a series of revolutions shattered the Austrian and Russian empires. Ukrainians declared independent statehood through autonomy in 1917 and in 1918 became the Ukrainian National Republic. However after several years of conflict and civil war, the western part of Ukrainian territory was incorporated into Poland, while the larger, central and eastern regions were incorporated into the Soviet Union in 1922 as the Ukrainian Soviet Socialist Republic.

After an initial period of Ukrainian revival under the Soviets, Stalin's rise to power at the end of the 1920's saw a period of rapid industrialisation, forced

collectivisation, and persecution of the intellectual class, which resulted in millions of deaths. Polish rule over its Ukrainian provinces ended in 1939, following Nazi and Soviet attack. Both eastern Galicia and Volhynia were annexed by the Soviet Union.

With World War II, the invading Nazis deported many Ukrainians to forced labour, carried out genocide of the Jews and killed many Ukrainian Soviet troops. Ukraine saw some of the biggest battles of the war starting with the encirclement of Kyiv (later acclaimed as a Hero City) where more than 660,000 Soviet troops were taken captive, to the fierce defence of Odessa, and on to the victorious storming across the Dnieper river.

In the decades following World War II, the Ukrainian republic again became a centre of industry and production. The republic was also turned into a Soviet military outpost in the cold war, a territory crowded by military bases packed with the most up-to-date weapons systems.

On April 26, 1986, the town of Pripyat was the site of the Chernobyl disaster. The nuclear plant explosion started a local independence movement. Ukraine became an independent state on August 24, 1991, following the dissolution of the Soviet Union.

Summary of Cultural Heritage Sites

There are several cultural UNESCO World Heritage Sites in Ukraine, as shown in Figure 3-46; these are:

- L'viv - the ensemble of the historic centre;
- The Struve geodetic arc (components are within the Khmelnytska and Odessa oblasts);
- Kyiv: Saint-Sophia Cathedral and related monastic buildings; Kyiv-Pechersk Lavra; and,
- Primeval Beech Forests of the Carpathian (Natural).

As shown in Figure 3-46, Ukraine also has sixteen submissions on the UNESCO tentative list. A state-organised and run project "Seven Wonders of Ukraine" has identified seven historical and cultural monuments of the country, that are perceived as high value by the society as a whole. These are all sites on the UNESCO World Heritage and Tentative Lists, with the addition of the 'Khortytsia' National Historic-Cultural Preserve (located on one of the largest islands of the Dnieper river) and the 'Khotyn Fortress' National Historic-Architectural Preserve on the Dniester River near Chernivtsi.

	
An entrance to Carpathian National Park near Vorokhta.	Kamyanets-Podilsky UNESCO tentative list site

At present in Ukraine there are official records for more than 140,000 objects of cultural heritage and 132,000 historical and archaeological monuments and items of monumental art, of which approximately 500 are of national importance. There are 15,600 urban and architectural monuments, of which more than 3,000 are monuments of national importance. In addition, Ukraine has 56 Individual Heritage Units and complexes with an exceptional historical value (state historical-cultural reservations), of which 12 have been granted the status of national reservations. In addition to this, 402 towns and municipalities of the urban type have been included on the List of Historically Inhabited Places of Ukraine. Figure 3-47 shows the historical-cultural reserves and places of Ukraine.

In addition, there is the unknown cultural heritage resource, which comprises archaeological sites which have not yet been discovered, many of these may have local, national or international importance.

(b) Cultural Heritage Future Trends in Baseline

The preservation of the cultural heritage resource in Ukraine is dependent on sensitive future development within the country combined with the effectiveness of Ukrainian policy and legislation.

Since the declaration of Ukrainian independence in 1991, there has been a drastic decrease in public support for culture due to political instability, the economic crisis, and contradictions between democratic goals and market conditions. The lack of a clear medium and long-term cultural development strategy resulted in the creation of ad hoc policies at the central and local levels. In most cases, these policies are aimed at preserving the existing situation. In 2008, National Board for Cultural Affairs (NBCA) together with the Presidential Secretariat, elaborated an operation plan (*The Roadmap to the Programme for Enrichment and Development of Culture and Spiritual Heritage of the Ukrainian Society*) defining three key strategic priorities. They are:

- integrity of the national linguistic and cultural space;
- updating national cultural heritage; and,

- protection of national cultural industries.

Development pressure in Ukraine stems from urbanisation, particularly in the west, continued growth of heavy industry and related energy generation. New development, if not undertaken sensitively and following Ukrainian environmental legislation, is likely to erode the Ukrainian cultural heritage resource.

(c) Cultural Heritage Data Sources

The baseline data on cultural heritage was largely compiled through internet sources and Ukrainian sources:

- National Atlas of Ukraine, ed. by L.G. Rudenko. Available from National Academy of Sciences of Ukraine Institute of Geography, 01034 Kyiv;
- History of Ukraine. Loosely translated and abridged by George Skoryk from "HISTORY OF UKRAINE" by Mykhaylo Hrushevs'kyi http://www.torugg.org/History/history_of_ukraine.html;
- P. Magosci, 1996, A History of Ukraine, excerpts found at http://www.conflicts.rem33.com/images/Ukraine/Early%20History.htm;
- UNESCO 2011. World Heritage List (http://whc.unesco.org/en/statesparties/ua); and,
- Wikepedia http://en.wikipedia.org/wiki/History_of_Ukraine and associated references.

(d) Cultural Heritage Data Quality

There is limited historical information about Ukraine that has been translated into English. However, in Ukrainian, historical information is generally well documented, as set out in the lists and registers attached to the Law of Ukraine 'On the Protection of Cultural Heritage'.

Due to the large scale of the study area and the strategic nature of this study, it was not possible to collect and interpret all of the available data concerning the cultural heritage of Ukraine. Only a limited number of available secondary sources of data were used, sufficient to provide enough information to assess the effects of future renewable energy development.

The quality of data for receptors used for this assessment is discussed here. Cultural heritage sites that are either internationally recognised or of outstanding importance within Ukraine, have been designated as Word Heritage Sites or have been moved forward to the Tentative List for designation. The Ukrainian Law on 'Protection of Cultural Heritage Sites' requires that all protected sites are recorded in the Inventory of Sites of National or Local Significance. These sites include paleontological and archaeological sites, built heritage, in additional to historic battlefields, war monuments and graves.

There may be additional sites which should be on the list, but have not yet been included for registration. This may be the case for sites with modern historical importance, such as particular buildings from the recent Soviet period, which may not be important in today's perspective but which may have greater historical value in years to come. Ukraine has a rich cultural history and there will be many unknown archaeological sites which are yet to be discovered. For example, discoveries on the islet of Sredeny Stih (to the northeast of Khortytsia), excavated during construction of the hydroelectric station in 1927, gave its name to the Seredeny Stih culture. Paleo-environmental remains preserved within waterlogged soils are often overlooked during construction and may provide an important record of past climates, biodiversity and landscapes.

Intangible cultural heritage is unlikely to be recorded, but encountered on a local level, and be attributed to customs and places of cultural value. For example, in the village of Krupove (Rivne oblast) the art of weaving traditional Ukrainian garments and crafts is still practiced on handmade, wooden looms.

(e) Cultural Heritage Data Gaps

Uncertainty is inherent in the cultural heritage topic, as available data can only describe the known heritage resource. The archaeological resource in Ukraine will also include unknown sites, which may be of local, national or international importance. Figure 3-47 shows the relative concentration of known sites within each oblast, which provides some indication of potential for unknown archaeology.

(f) Cultural Heritage Constraints and Opportunities of Renewable Energy

The key constraints and opportunities for renewable energy in relation to cultural heritage are summarised in Table 3-13.

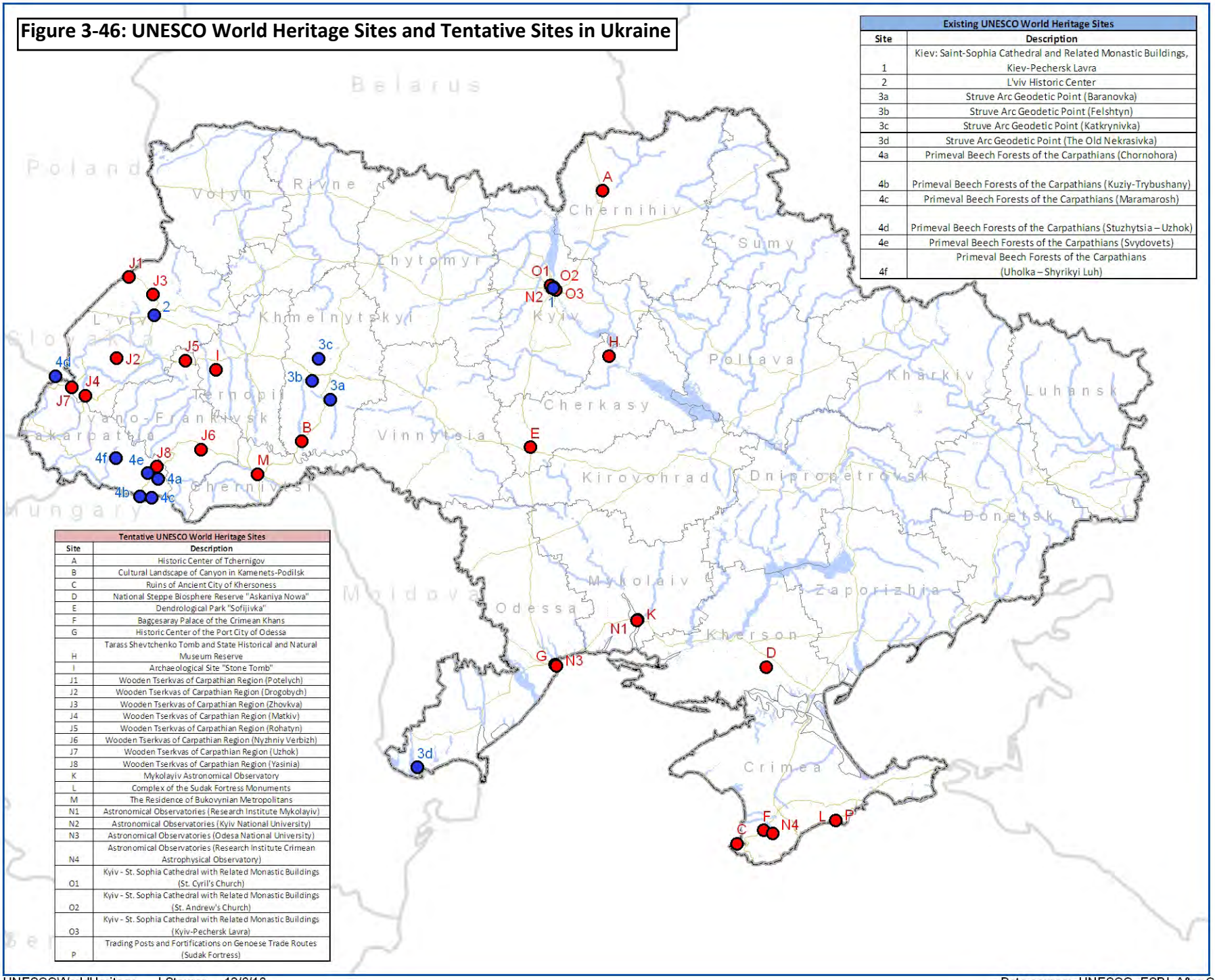
Table 3-13: constraints and opportunities in relation to cultural heritage

Constraints	Opportunities
• Possible conflicts with local communities and authorities over the land use; and, • Probability of discovering or extending cultural heritage sites' territories, thus limiting potential renewable energy project siting.	• Opportunity to support cultural heritage development as one of mitigation measures within renewable energy projects; and, • Siting of renewable energy projects on natural heritage sites for demonstration purposes.

(g) Cultural Heritage Figures

The figures that follow have been referenced within Section 3.7 of this Topic Paper (the Cultural Heritage baseline and future baseline text):

Figure 3-46: UNESCO World Heritage Sites and Tentative Sites in Ukraine



Existing UNESCO World Heritage Sites	
Site	Description
1	Kiev: Saint-Sophia Cathedral and Related Monastic Buildings, Kiev-Pechersk Lavra
2	L'viv Historic Center
3a	Struve Arc Geodetic Point (Baranovka)
3b	Struve Arc Geodetic Point (Felshtyn)
3c	Struve Arc Geodetic Point (Katkrynivka)
3d	Struve Arc Geodetic Point (The Old Nekrasivka)
4a	Primeval Beech Forests of the Carpathians (Chornohora)
4b	Primeval Beech Forests of the Carpathians (Kuziy-Trybushany)
4c	Primeval Beech Forests of the Carpathians (Maramarosh)
4d	Primeval Beech Forests of the Carpathians (Stuzhytsia – Uzhok)
4e	Primeval Beech Forests of the Carpathians (Svydovets)
4f	Primeval Beech Forests of the Carpathians (Uholka – Shyrikyi Luh)

Tentative UNESCO World Heritage Sites	
Site	Description
A	Historic Center of Tchernigov
B	Cultural Landscape of Canyon in Kamenets-Podilsk
C	Ruins of Ancient City of Khersoness
D	National Steppe Biosphere Reserve "Askaniya Nowa"
E	Dendrological Park "Sofijivka"
F	Bagcesaray Palace of the Crimean Khans
G	Historic Center of the Port City of Odessa
H	Tarass Shevtchenko Tomb and State Historical and Natural Museum Reserve
I	Archaeological Site "Stone Tomb"
J1	Wooden Tserkvas of Carpathian Region (Potelych)
J2	Wooden Tserkvas of Carpathian Region (Drogobych)
J3	Wooden Tserkvas of Carpathian Region (Zhovkva)
J4	Wooden Tserkvas of Carpathian Region (Matkiv)
J5	Wooden Tserkvas of Carpathian Region (Rohatyn)
J6	Wooden Tserkvas of Carpathian Region (Nyzhniy Verbizh)
J7	Wooden Tserkvas of Carpathian Region (Uzhok)
J8	Wooden Tserkvas of Carpathian Region (Yasinia)
K	Mykolayiv Astronomical Observatory
L	Complex of the Sudak Fortress Monuments
M	The Residence of Bukovynian Metropolitans
N1	Astronomical Observatories (Research Institute Mykolayiv)
N2	Astronomical Observatories (Kyiv National University)
N3	Astronomical Observatories (Odesa National University)
N4	Astronomical Observatories (Research Institute Crimean Astrophysical Observatory)
O1	Kyiv - St. Sophia Cathedral with Related Monastic Buildings (St. Cyril's Church)
O2	Kyiv - St. Sophia Cathedral with Related Monastic Buildings (St. Andrew's Church)
O3	Kyiv - St. Sophia Cathedral with Related Monastic Buildings (Kyiv-Pechersk Lavra)
P	Trading Posts and Fortifications on Genoese Trade Routes (Sudak Fortress)

Ukraine Sustainable Energy Lending Facility Strategic Environmental Review

UNESCO World Heritage Sites

Legend

UNESCO World Heritage Sites

- Existing Sites
- Tentative Sites

N
W E
S

0 50 100
Kilometers
1 cm = 60 km

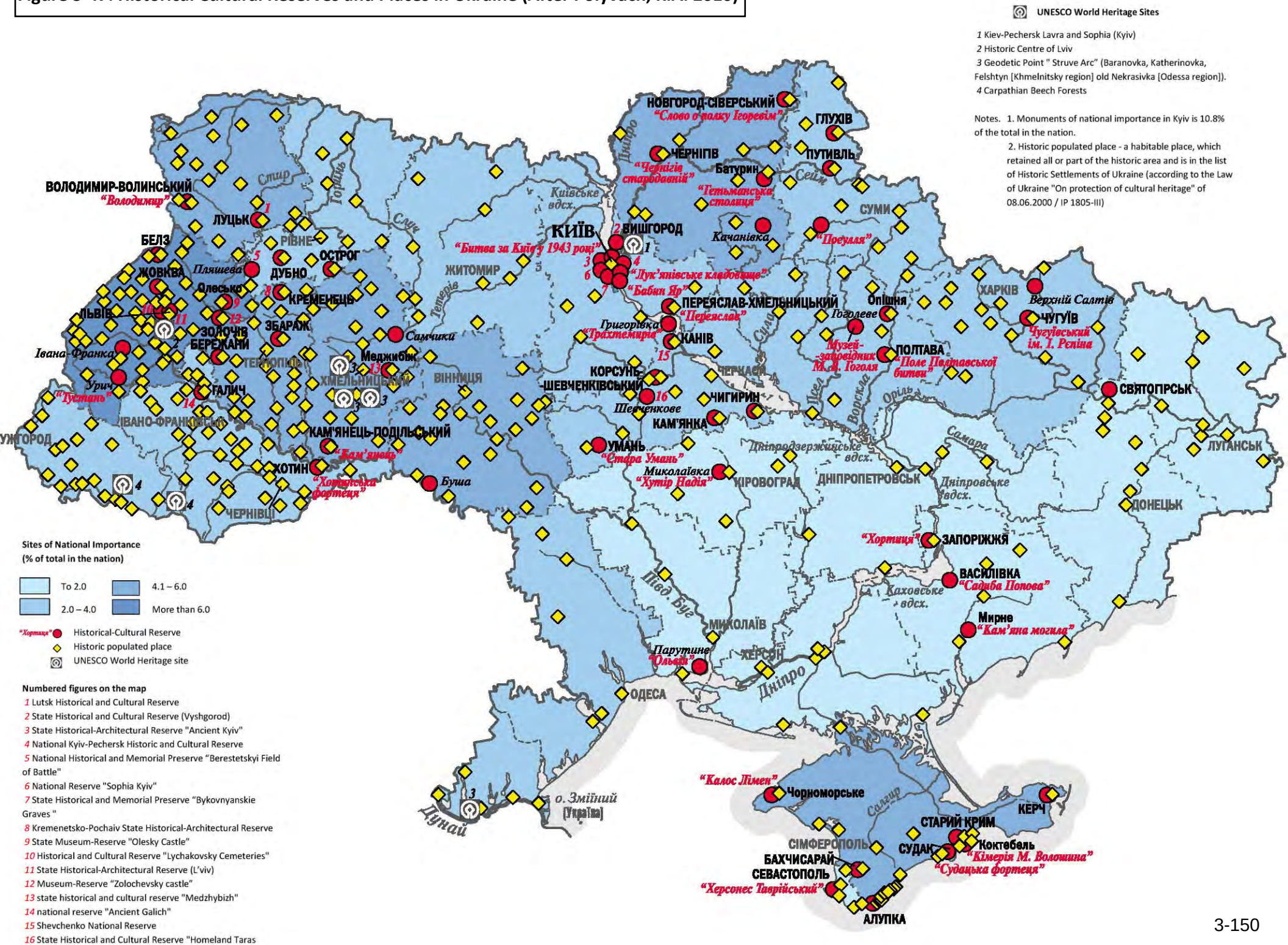
USELF
Ukraine Sustainable Energy Lending Facility

BLACK & VEATCH
Building a world of difference.

UNESCOWorldHeritage J.Steurer 12/6/10

Data source: UNESCO, ESRI, After C.A. Polyvach, National Atlas of Ukraine.

Figure 3-47: Historical Cultural Reserves and Places in Ukraine (After Polyvach, K.A. 2010)



4. RECEPTORS AND KEY ENVIRONMENTAL ISSUES

4.1 Introduction

The receptors and key environmental issues for each topic associated with each of the renewable energy resource scenarios being considered are shown in the following tables:

- Climate and Air Quality: Table 4-1;
- Surface Water and Groundwater: Table 4-2;
- Geology, Soils and Land Use: Table 4-3;
- Landscape and Biodiversity: Table 4-4;
- Community and Socio-economics: Table 4-5; and,
- Cultural Heritage: Table 4-6.

Table 4-1: Receptors and Environmental Issues for Climate and Air Quality

Receptor	Supporting attributes	Issue by Renewable Energy Type				
		Wind (onshore)	Solar PV	Small Hydro	Biomass	Biogas
Climate	• Climatic Zones • Precipitation • Temperature • Sunlight (characterised as Direct Normal Insolation) • Wind (velocity and select wind roses) • Data on climate change trends	None			Deforestation could result in climate pattern changes and mudslides and increased flooding.	None
Air quality	• Particulate and other Criterion Pollutants by major regions • Deposition • Ground level fogging and icing • Air quality trends • Industrial and Rural Areas • Attainment and nonattainment of ambient air quality standards, if present	Construction stage air emissions. Material transportation and changes to carbon emissions from alternative energy			Construction and operation air emissions. Potential for generation of hazardous air pollutants. Greenhouse gas emissions; primarily from combustion of fuel materials and production /transportation of fuel crops to site. Change to carbon sequestration from production/cropping of fuel materials. Ground and water deposition of air pollutants. Fogging and icing from cooling tower plumes. Emissions from combustion of fuels in stationary and mobile sources.	Construction and operation air emissions. Potential for generation of hazardous air pollutants. Greenhouse gas emissions; primarily from combustion. Possibility of methane gas leaks from pipelines and valves. Gas combustion is usually clean and should have little or no impact Gas combustion is usually clean and should have little or no impact
Odour	• Odour levels	Odour issues during construction and operation			Odour issues related to type of biomass combusted	Odour issues related to type of biogas combusted

Table 4-2: Receptors and Environmental Issues for Surface Water and Groundwater

Receptor	Supporting attributes	Issue by Renewable Energy Type				
		Wind (onshore)	Solar PV	Small Hydro	Biomass	Biogas
Surface Water Resource	• List of key water bodies and watercourses and map of hydrography network • Map of main watersheds and hydrologic regimes • Channel processes • Surface water withdrawals	None	None	Availability of river discharge records or new monitoring for flow (storage, generation and flow (turbines). Elevation change (head) for generation. Effect of changes to flow patterns (may be some increases at low flows as well as decreases of high flows – both can be detrimental). Changes to river dynamics and morphology.	Use of water during operation. Biofuel production altering freshwater resource. Surface water run-off regime leading to changes in river dynamics and morphology.	Use of water during operation.
Surface water quality	• Parameters by regions (surface water monitoring data)	Construction activities may result in increased erosion and sedimentation of surface waters.	Construction activities may result in increased erosion and sedimentation of surface waters. Altered land drainage characteristics during operation may result in sediment mobilisation into rivers.	Construction activities may result in increased erosion and sedimentation of surface waters. Potential operational impact upon water quality due to disruption of flow, sediment dynamics, etc.	Emissions of water effluent to rivers following appropriate treatment. Altered land drainage characteristics during operation may result in sediment mobilisation into rivers.	Potential for altered groundwater quality from changes in landfill runoff, seepage and infiltration patterns from LFG installation and operation
Flooding regime	• Floodplains/ flood control	Vegetation clearance during construction	Vegetation clearance during construction	Potential changes to flooding regimes up and	Potential to increase extent of flood risk and	Altered land drainage

Receptor	Supporting attributes	Issue by Renewable Energy Type				
		Wind (onshore)	Solar PV	Small Hydro	Biomass	Biogas
	structures and practices	and placement of turbines and ancillary facilities in floodplains could increase catchment flooding potential.	and placement of PV equipment in floodplains could increase catchment flooding potential.	downstream, particularly with new hydropower developments	surface water flow due to land-take for fuel handling and storage areas.	characteristics, and potential for increased extent of flood risk and surface water flow.
Groundwater Resource	• Hydrogeological map and major aquifers • Groundwater withdrawals/wells • Groundwater availability by regions	None	None	Potential for altered groundwater quality and regime if in hydraulic continuity with surface waters affected by hydropower.	Potential for altered groundwater recharge/extraction regime if groundwater used for steam generation and fuel processing.	Potential for limited alteration of groundwater from changes in landfill runoff, seepage, and infiltration patterns
Groundwater quality	• Groundwater monitoring data	None	None	None	Potential for groundwater infiltration of pollutants during construction and operation.	Potential for groundwater infiltration of pollutants during construction and operation.

Table 4-3: Receptors and Environmental Issues for Geology and Soils

Receptor	Supporting attributes	Issue by Renewable Energy Type				
		Wind (onshore)	Solar PV	Small Hydro	Biomass	Biogas
Bedrock Geology	• Location of facility relative to underlying bedrock geology	Very localised geological damage though piling of turbines and laying of transmission networks.	Very localised geological damage though laying of transmission networks (PV panel placement unlikely to affect geology).	Very localised geological damage through construction activities. Altered environmental risks due to impoundment of water in seismic zone.	Very localised geological damage through laying of transmission networks and potentially through piling for placement of towers for heat capture.	Very localised geological damage though construction of plant and transmission networks.
Landslide Hazard Areas	• Topography derived >50% slopes • Brownfield sites • Location of facility relative to mountainous and hilly regions, steep river banks and coastlines.	Localised impact from construction development(vibration, blasting, , clearing & grading level site). Localised impact from vibrations and downwash during operations	Localised impact from construction development (vibration, blasting, , clearing & grading level site)	Localised impact from saturation of soils under reservoirs. Localised damage from large landslides in mountainous areas can result in landslide dams blocking river courses Regional impact from failure of dams and reservoirs	Localised impact from construction development, clearing & grading level site Localised impact from removal of vegetation.	Localised damage through construction and operation on landfill affecting its stability
High Value Soils	• Location of facility on or adjacent to productive soils.	Construction activities resulting in soil erosion and compaction. Replacement / removal of lands from agricultural production.	Construction activities resulting in soil erosion and compaction. Replacement / removal of lands from agricultural production	Construction activities resulting in soil erosion and compaction. Inundation / removal of lands from agricultural production for impoundment facilities.	Construction activities resulting in soil erosion, compaction, and/or contamination. Replacement / removal of lands from agricultural production	Construction activities resulting in soil erosion, compaction, and/or contamination. Replacement / removal of lands from agricultural production

Receptor	Supporting attributes	Issue by Renewable Energy Type				
		Wind (onshore)	Solar PV	Small Hydro	Biomass	Biogas
Contaminated Land	• Areas of contaminated soils	Excavation for foundations could liberate previously contaminated soils	Grading and foundations could liberate previously contaminated soils	Construction activities for in-ground equipment and piping for run-of-river systems could liberate contaminated soils and sediments and secondarily, impact water quality	Construction activities for in-ground equipment could liberate contaminated soils Contamination and acidification via releases from concentrated animal waste lagoons and landfill leachate could contaminate additional soils.	Construction activities for in-ground equipment could liberate contaminated soils. Construction activities may impact the landfill cover and allow landfill contaminants to contaminate adjacent soils and surface waters.
Soils Classification	• Physical characteristics (i.e. total soluble salts, soil texture, distribution of particle size, % of sand, silt and clay, etc.) • Chemical properties (i.e. pH, electrical conductivity, nitrates, phosphorus, potassium, sodium, calcium, magnesium, chlorides, organic matter, etc)	Localised erosion, compaction, salinisation, sealing and/or contamination from site alteration and project activities could wash away fines and change the soil's properties.	Localised erosion, compaction, salinisation, sealing and/or contamination from site alteration and project activities could wash away fines and change the soil's properties.	Localised erosion, compaction, salinisation, sealing and/or contamination from site alteration and project activities could wash away fines and change the soil's properties.	Localised erosion, compaction, salinisation, sealing and/or contamination from site alteration and project activities could wash away fines and change the soil's properties.	Localised erosion, compaction, salinisation, sealing and/or contamination from site alteration and project activities could wash away fines and change the soil's properties.

Table 4-4: Receptors and Environmental Issues for Landscape and Biodiversity

Receptor	Supporting attributes	Issue by Renewable Energy Type				
		Wind (onshore)	Solar PV	Small Hydro	Biomass	Biogas
Protected Landscapes	• Biosphere reserves • World Heritage Sites • Ramsar sites • National Parks	Impacts on landscape character and visual amenity over wide areas due to large footprint and height of turbines. Impacts on the scenic value and setting of Biosphere Reserves and National Parks.	Large footprint of land-take will impact on landscape character over wide areas. Local impacts on landscape character and visual amenity, associated with ancillary development (buildings and pylons). Impacts on the scenic value and setting of Biosphere Reserves and National Parks.	Reservoirs and dams will have impacts on landscape character over wide areas. Local impacts on landscape character and visual amenity, associated with ancillary development (buildings and pylons). Impacts on the scenic value and setting of Biosphere Reserves and National Parks.	Large footprint of land-take and height of boiler building will impact on landscape character and visual amenity over wide areas. Impacts on the scenic value and setting of Biosphere Reserves and National Parks.	Impacts on landscape character and visual amenity, associated with land take and ancillary development (buildings and pylons). Impacts on the scenic value and setting of Biosphere Reserves and National Parks.
Protected Biodiversity Areas	• Biosphere reserves • World Heritage Sites • Ramsar sites • National Parks	Protected terrestrial habitat loss (e.g. National parks). Fragmentation of ecosystems from footprint, access roads and transmission networks. Reduction in populations of migratory bird species due to strike associated with turbines or	Footprint /land-take for solar PV arrays. Limited habitat re-growth potential due to presence of PVs. Fragmentation of ecosystems from footprint, access roads and transmission networks.	Impacts on aquatic ecosystems, including fragmentation of ecosystems from footprint (including transmission routes) and changes in water flows affecting river habitats. Loss/conversion of habitat due to impounded water from impoundment systems.	Land-take from footprint of power station, network infrastructure and biofuel production. Fragmentation of ecosystems. Water resource competition for habitats; degradation from emissions to air and water.	Land-take from footprint of power station, network infrastructure and biofuel production. Fragmentation of ecosystems. Water resource competition for habitats; degradation from emissions to air and water.

Receptor	Supporting attributes	Issue by Renewable Energy Type				
		Wind (onshore)	Solar PV	Small Hydro	Biomass	Biogas
		transmission lines. Potential impacts to bats and soil organisms due to vibration/noise.		Loss impacts to aquatic habitat due to pipeline placement in stream or adjacent floodplain habitat.		
Aquatic Ecosystems	Biological quality elements: • Anadromous Fish Routes • Endemic fish populations • Aquatic invertebrates • Physico chemical supporting elements	Ecological impacts in local water bodies as a result of sediment deposition from stormwater runoff	Ecological impacts in local water bodies as a result of sediment deposition from stormwater runoff	Blockage of migratory routes; Fish entrainment/ impingement Upstream/downstream flow and habitat modification Water quality impacts during construction and operation	Ecological impacts due to changes in water quality in local water bodies due to sediment and contaminants in stormwater runoff, Wastewater discharges, Water withdrawals	Ecological impacts due to changes in water quality in local water bodies due to sediment and contaminants in stormwater runoff, wastewater discharges, and water withdrawals
Protected Species	• Distribution data or habitat areas for Red Book species • Bat populations • Bird migration pathways	Disturbance of habitat during construction Bird and bats strike (turbines and transmission) and footprint Habitat loss impacts upon terrestrial species.	Disturbance of habitat during construction Land-take footprint impacts upon terrestrial species.	Footprint impacts upon species from infrastructure (inc. transmission lines, flooded valleys, quarrying etc.).	Land-take from footprint of power plant Network infrastructure and fuel production and supply network. Noise, emissions, water consumption and vibration.	Land-take from footprint of power plant Network infrastructure and fuel production and supply network. Noise, emissions, water consumption and vibration.
High quality unregulated	• Landscape character features associated	Impacts on landscape character and visual	Large footprint of land-take will impact on	Reservoirs and dams will have impacts on	Large footprint of land-take and height	Impacts on landscape

Receptor	Supporting attributes	Issue by Renewable Energy Type				
		Wind (onshore)	Solar PV	Small Hydro	Biomass	Biogas
landscapes (Undisturbed natural landscape, traditionally managed & scenic and historic towns/villages/features)	with original steppe, and areas of forest and alpine meadow in the Carpathians and Crimea • Visual Amenity • People	amenity over wide areas due to large footprint and height of turbines.	landscape character over wide areas. Local impacts on landscape character and visual amenity, associated with ancillary development (buildings and pylons).	landscape character over wide areas. Local impacts on landscape character and visual amenity, associated with ancillary development (buildings and pylons).	of boiler building will impact on landscape character and visual amenity over wide areas.	character and visual amenity, associated with land take and ancillary development (buildings and pylons).
Low quality landscapes (Degraded and or intensively used landscapes, typically intensive arable, intensive livestock units, industrialised and urban landscapes)	• Landscape character associated with areas of intensively farmed arable land • Visual amenity • People	Impacts on landscape character and visual amenity over wide areas due to large footprint and height of turbines.	Large footprint of land-take will impact on landscape character over wide areas. Local impacts on landscape character and visual amenity, associated with ancillary development (buildings and pylons).	Reservoirs and dams will have impacts on landscape character over wide areas. Local impacts on landscape character and visual amenity, associated with ancillary development (buildings and pylons).	Large footprint of land-take and height of boiler buildings will impact on landscape character and visual amenity over wide areas.	Impacts on landscape character and visual amenity, associated with land take and ancillary development (buildings and pylons).
Unprotected remnant natural ecosystems	• Forest • Yaila and meadows • Steppe grassland • River corridors • Steppe savannah	Footprint losses of remnant undesignated natural habitats.	Footprint losses of remnant undesignated natural habitats.	Footprint losses of remnant undesignated natural habitats	Footprint losses of remnant undesignated natural habitats	Footprint losses of remnant undesignated natural habitats
Unprotected adapted ecosystems	Ecosystems adapted to more intensive urban land use such as croplands and urban/ rural fringes.	Footprint losses of adapted habitats.	Footprint losses of adapted habitats.	Footprint losses of adapted habitats.	Footprint losses of adapted habitats.	Footprint losses of adapted habitats.

Table 4-5: Receptors and Environmental Issues for Community and Socio-economics

Receptor	Supporting attributes	Issue by Renewable Energy Type				
		Wind (onshore)	Solar PV	Small Hydro	Biomass	Biogas
Demographics	• Population • Population density • Age • Ethnicity	Potential ethnic disputes over placement. Possible resettlement or relocation of economic activities	Potential ethnic disputes over placement. Possible resettlement or relocation of economic activities	Potential ethnic disputes over placement. Possible resettlement or relocation of economic activities	Potential ethnic disputes over placement	Potential ethnic disputes over placement
Health	• Longevity • Birth rate • Death rate • Causes of death	Potential disruption due to noise and dust during construction. Operational noise and vibration	Potential disruption due to noise and dust during construction	Impacts on drinking water and air quality. Potentially disruption due to noise and dust during construction	Potential off- gasing, smoke and dust. Potential improvement in respiratory health because of cessation of seasonal burning of biomass in fields	Potential improvement because burning reduces public exposure to odour and particulate matter from existing landfills.
Employment/ Earnings	• Income • GDP/Capita by oblast	Increased employment in rural areas for installation and maintenance Provides a long-term lower cost source of energy that will help stabilise energy costs.	Increased employment in rural areas for installation and maintenance Provides a long-term lower cost source of energy that will help stabilise energy costs.	Loss of aesthetic value for areas with tourism potential, Increased employment in rural areas for installation and maintenance Provides a long-term lower cost source of energy that will help stabilise energy costs.	Loss of aesthetic value for areas with tourism potential, Increased employment in rural areas for installation and maintenance Provides a long-term lower cost source of energy that will help stabilise energy costs.	Loss of aesthetic value for areas with tourism potential, Increased employment in rural areas for installation and maintenance Provides a long-term lower cost source of energy that will help stabilise energy costs.
Economic Sectors	• Industry • Mining • Agriculture	Possible temporary disruption of livestock land use for	Loss of resource areas for mineral extraction, agriculture, and	Possible alteration of river flows for irrigation.	Small loss of soil fertility for agriculture from shift in burning	Possible dual use positive impacts of feedlots for biogas

Receptor	Supporting attributes	Issue by Renewable Energy Type				
		Wind (onshore)	**Solar PV**	**Small Hydro**	**Biomass**	**Biogas**
		grazing during construction. Potential improvement to reliability of energy supply. Loss of resource areas for mineral extraction, agriculture, and industry due to facility footprint	industry due to facility footprint Potential improvement to reliability of energy supply.	Loss of resource areas for mineral extraction, agriculture, and industry due to facility footprint Possible alteration in river flow for use in mining and industrial activities Potential improvement to reliability of energy supply.	to biomass accumulation for power Loss of resource areas for mineral extraction, agriculture, and industry due to facility footprint Potential improvement to reliability of energy supply.	accumulation. Potential improvement to reliability of energy supply.
Infrastructure	• Transportation (Road/Highways, Rail, Airports and approaches, Ports, • Energy Existing and planned transmission lines, • Gas pipelines	Visual impact affecting property value. Potential improvement to reliability of energy supply. Potential effects on radar. Impacts to traffic patterns during construction.	Visual impact affecting property value. Potential improvement to reliability of energy supply. Impacts to traffic patterns during construction.	Footprint impacts and potential for alterations to water regime resulting in altered flood risk and water resources available for abstraction Property value effects. Possible damage to infrastructure for large equipment and	Land-take footprint impacts. Visual impact and changes to infrastructure affecting property value. Potential improvement to reliability of energy supply. Impacts to traffic patterns during	Land-take footprint impacts. Visual impact and changes to infrastructure affecting property value. Potential improvement to reliability of energy supply Impacts to traffic patterns during

Receptor	Supporting attributes	Issue by Renewable Energy Type				
		Wind (onshore)	**Solar PV**	**Small Hydro**	**Biomass**	**Biogas**
				material transportation. Impacts to traffic patterns during construction.	construction.	construction.
Tourism and Environmental Amenities	• Hunting • Beaches • Fishing • Skiing • Conventional tourism • Eco-tourism • Availability of potable water • Contaminated sites	Visual and land access impact on recreational activities such as hiking, eco-tourism, fishing and hunting. Improvements to infrastructure and interest in renewable energy could increase eco-tourism.	Visual and land access impact on recreational activities such as hiking, eco-tourism, fishing and hunting. Improvements to infrastructure and interest in renewable energy could increase eco-tourism.	Visual and land access impact on recreational activities such as hiking, eco-tourism, fishing and hunting. Improvements to infrastructure and interest in renewable energy could increase eco-tourism.	Visual and land access impact on recreational activities such as hiking, eco-tourism, fishing and hunting. Improvements to infrastructure and interest in renewable energy could increase eco-tourism.	None

Table 4-6: Receptors and Environmental Issues for Cultural Heritage

Receptor	Supporting attributes	Issue by Renewable Energy Type				
		Wind (onshore)	Solar PV	Small Hydro	Biomass	Biogas
UNESCO World Heritage Sites	• Cultural sites of outstanding value • Natural sites of outstanding value	Loss or damage to resource due to construction. Visual intrusion into cultural landscape.	Loss or damage to resource due to construction. Visual intrusion into cultural landscape.	Loss or damage to resource due to construction. Visual intrusion into cultural landscape.	Loss or damage to resource due to construction. Visual intrusion into cultural landscape.	Loss or damage to resource due to construction. Visual intrusion into cultural landscape.
Registered cultural heritage sites.	• Palaeontological sites, palaeo-environmental deposits. • Archaeological sites • Built heritage (e.g. historic buildings, monuments) • Battlefields / War Monuments / Burial Grounds	Loss or damage to resource due construction. Visual intrusion into cultural landscape.	Loss or damage to resource due construction. Visual intrusion into cultural landscape.	Loss or damage to resource due construction. Visual intrusion into cultural landscape.	Loss or damage to resource due construction. Visual intrusion into cultural landscape.	Loss or damage to resource due construction. Visual intrusion into cultural landscape.
Unknown or unregistered cultural heritage sites	• Areas of Palaeontological or palaeo-environmental potential (e.g. where conditions for preservation are good) • Main Archaeologically hotspots / zones and sites. • Archaeological sites Built heritage (e.g. historic buildings) Places with historical or cultural interest.	Loss or damage to resource due construction. Visual intrusion into cultural landscape.	Loss or damage to resource due construction. Visual intrusion into cultural landscape.	Loss or damage to resource due construction. Visual intrusion into cultural landscape.	Loss or damage to resource due construction. Visual intrusion into cultural landscape.	Loss or damage to resource due construction. Visual intrusion into cultural landscape
Intangible cultural heritage	• Practices and traditions • Knowledge and skills • Values • Associated objects, artefacts, instruments and cultural spaces for the above.	Loss, partial loss, change or disruption to resource	Loss, partial loss, change or disruption to resource	Loss, partial loss, change or disruption to resource	Loss, partial loss or disruption to resource	Loss, partial loss or disruption to resource

5. SENSITIVITY OF RECEPTORS

5.1 Introduction

The sensitivity of receptors to the various renewable energy scenarios is presented for each environmental receptor in the following sections. This forms the first stage in the SER assessment of environmental effects of the renewable energy scenarios.

This SER has used expert judgement to determine the sensitivity of receptors based on the value of each receptor against the vulnerability of that receptor to changes resulting from each renewable energy scenario (as shown in Table 5-1). Value and vulnerability of receptors are defined as follows:

Value = based on geographic scale, legal protection, rarity and importance of the receptor.

Vulnerability = based on likelihood of receptor being exposed to an environmental effect from USELF, and the receptor's tolerance and resilience to a given environmental effect.

Table 5-1: Calculation of Receptor Sensitivity

		Value	
		High – receptor is rare, important for social or economic reasons, legally protected, of international or national designation	**Low** – receptor is common, of local or regional designation
Vulnerability	**High** e.g. potential pathways exist for environmental change in receptors as a result of USELF, receptor is in a declining condition, dependent on a narrow range of environmental conditions	High	Medium
	Medium *e.g.* few pathways exist for environmental change in receptors as a result of USELF, receptor is only expected to recover from disturbance over a prolonged period of time, if at all	Medium	Medium
	Low *e.g.* limited or no pathways exist for environmental change in receptors as a result of USELF, receptor is in stable or favourable condition &/ or dependent on wide range of environmental conditions	Medium	Low
	None e.g. no pathways exist between environmental changes and receptors, receptor is insensitive to disturbance	None	None

5.2 Climate and air quality

The value, vulnerability and sensitivity of the environmental receptors for this topic are shown in Table 5-2.

Table 5-2: Sensitivity of receptors for Climate and Air Quality

		Wind (onshore)		Solar PV		Small Hydro		Biomass		Biogas	
Receptor	**Value**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**
Climate	High – climate is of international importance	None – climate will not be affected by installation of schemes to utilise wind resources	None	None – climate will not be affected by installation of solar PV	None	None - climate will not be affected by installation of schemes to utilise hydro resources	None	Low – there is potential for limited change in climatic conditions as a result of schemes utilising biomass	Medium	None - Climate will not be affected by installation of biogas systems	None
Air quality	High –maintaining and enhancing air quality is of national importance	Low - there is potential for limited air quality impacts during construction	Medium	Low - there is potential for limited air quality impacts during construction	Medium	Low - there is potential for limited air quality impacts during construction	Medium	Medium – emissions will occur during both construction and operation.	Medium	Low – emissions during operation will be comparably lower than for biomass combustion	Medium
Odour	Low - Nuisance odour is a matter of concern for local population.	None	None	None	None	None	None	Medium - emissions will occur during operation.	Medium	Medium - emissions will occur during operation.	Medium

5.3 Surface Water and Groundwater

The value, vulnerability and sensitivity of the environmental receptors for this topic are shown in Table 5-3.

Table 5-3: Sensitivity of receptors for Surface Water and Groundwater

		Wind (onshore)		Solar PV		Small Hydro		Biomass		Biogas	
Receptor	**Value**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**
Surface Water Resource	High – availability of surface water resources is of national importance	None – surface water resources will not be influenced by schemes to utilise wind resources	None	None – surface water resources will not be influenced by schemes to utilise solar resources	None	High – surface water availability is very susceptible to change as a result of schemes to utilise hydro resources	High	Medium – potential for moderate water consumption requirement for cooling towers.	Medium	Low – minimal volumes of water required.	Medium
Surface water quality	High – quality of surface water resources is of national importance	Low – construction activities, such as installation of turbine foundations, underground cables and access roads, may result in erosion, surface run-off and sedimentatio	Medium	None – surface water quality will not be influenced by schemes to utilise solar resources	None	Medium – small hydro scheme operations may impact pollutant discharge and dilution as well as oxygen levels.	Medium	Medium – potential for runoff of polluting residues from onsite fuel storage (particularly chemicals and agricultural residues)	Medium	Medium – potential for runoff of polluting residues from construction activities and fuel delivery and storage areas.	Medium

		Wind (onshore)		Solar PV		Small Hydro		Biomass		Biogas	
Receptor	**Value**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**
		n of surface waters.									
Flooding regime	High – flood risk is an area of national importance (especially in the western oblasts)	Low – potential impacts upon flooding regime in flood prone areas following vegetation clearance or relatively small amount of landtake	Medium	Low – potential impacts upon flooding regime in flood prone areas following vegetation clearance or relatively small amount of landtake	Medium	High – potential to impact flooding regimes up and downstream of new hydro developments	High	Medium – potential impacts on flooding regime following vegetation clearance and moderate landtake for fuel handling and storage areas required.	Medium	Low – requires existing landfill site or small land-take area for animal waste digestion.	Medium
Groundwater Resource	High – availability of groundwater resources is of national importance	None – groundwater resources will not be influenced by installation of schemes to utilise wind resources	None	None – groundwater resources will not be influenced by utilisation of solar resources	None	Low – potential for localised alterations to groundwater recharge/ extraction regime	Medium	Medium – potential for moderate water consumption requirement for cooling towers.	Medium	Low – minimal volumes of water required.	Medium
Groundwater quality	High – quality of groundwater resources is of national importance	None – ground water quality will not be influenced by installation of	None	None – ground water quality will not be influenced by utilisation of	None	Low – potential for localised alterations to groundwate	Medium	Medium – potential for groundwater infiltration of polluting residues	Medium	Medium – potential for alterations to landfill runoff and seepage leading to	Medium

		Wind (onshore)		Solar PV		Small Hydro		Biomass		Biogas	
Receptor	**Value**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**
		schemes to utilise wind resources		solar resources		r quality due to short term construction activities		from onsite fuel storage (particularly animal waste)		changes to groundwater quality.	

5.4 Geology and soils

The value, vulnerability and sensitivity of the environmental receptors for this topic are shown in Table 5-4.

Table 5-4: Sensitivity of receptors for Geology and Soils

		Wind (onshore)		Solar PV		Small Hydro		Biomass		Biogas	
Receptor	**Value**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**
Bedrock Geology	Low – geology common to localities or region	Low – pathways limited to construction blasting, drilling and foundation s	Low	Low – pathways limited to construction blasting, drilling and foundations	Low	Low – pathways limited to dam construction blasting, drilling and foundation s	Low	Low – pathways limited to plant construction blasting, drilling and foundation s	Low	Low – pathways limited to project construction blasting, drilling and foundation s	Low
Landslide Hazard Areas	Low – landslide hazards mostly in mountainous or hilly regions, adjacent to steep river banks, and along southern coastline mostly detrimental to environment, public health & welfare	Low – limited vulnerability as wind schemes are largely built on relatively flat land where landslide risk is low	Low	Low – limited vulnerability as solar PV schemes are largely built on relatively flat land where landslide risk is low	Low	Medium – project construction activities, land clearing, vegetation removal, inundation and alternation of drainage may provide pathway for creating change / landslide	Medium	Low – limited vulnerability as biomass schemes are largely built on relatively flat land where landslide risk is low	Low	Low – limited vulnerability as biogas schemes are largely built on relatively flat land where landslide risk is low	Low

		Wind (onshore)		Solar PV		Small Hydro		Biomass		Biogas	
Receptor	**Value**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**
High Value Soils	High – widespread, but primarily in East European Plain, chernozems and other high value soils critical to agricultural productivity and economy	Medium – construction activities, land clearing, removal of vegetation, alteration of drainage can increase erosion / loss of receptor	Medium	Medium – construction activities, land clearing, removal of vegetation, alteration of drainage can increase erosion / loss of receptor	Medium	Medium – construction activities, land clearing, removal of vegetation, alteration of drainage can increase erosion / loss of receptor	Medium	Medium – construction activities, land clearing, removal of vegetation, alteration of drainage can increase erosion / loss of receptor	Medium	Medium – construction activities, land clearing, removal of vegetation, alteration of drainage can increase erosion / loss of receptor	Medium
Contaminated Land	Low – localised areas of pesticide or other contaminates adjacent to industry, as well as " Zone of Alienation" near Prypiat unproductive	Low – localised disturbances from foundation excavations and spillage or release of chemicals or petroleum hydrocarbons can cause further degradation of receptor	Low	Low – localised disturbances from foundation excavations and spillage or release of chemicals or petroleum hydrocarbons can cause further degradation of receptor	Low	Low – localised disturbances from foundation excavations and spillage or release of chemicals or petroleum hydrocarbons can cause further degradation of receptor	Low	Low – localised disturbances from foundation excavations and spillage or release of chemicals or petroleum hydrocarbons can cause further degradation of receptor	Low	Medium – disturbances from foundation excavations and spillage or release of chemicals or petroleum hydrocarbons, as well as excessive application of animal wastes and releases of leachate and wastes from landfills can cause	Medium

		Wind (onshore)		Solar PV		Small Hydro		Biomass		Biogas	
Receptor	**Value**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**
										further degradation of receptor	
Soils Classification	Low - soils of all classifications are common and local	Medium - removal of vegetation, erosion, release of chemicals, and compaction under heavy equipment and facilities can effect changes in existing soil classification	Medium	Medium - removal of vegetation, erosion, release of chemicals, and compaction under heavy equipment and facilities can effect changes in existing soil classification	Medium	Medium - removal of vegetation, erosion, release of chemicals, and compaction under heavy equipment and facilities can effect changes in existing soil classificatio n	Medium	Medium - removal of vegetation, erosion, release of chemicals, and compaction under heavy equipment and facilities can effect changes in existing soil classification	Medium	Medium - removal of vegetation, erosion, release of chemicals, and compaction under heavy equipment and facilities, as well as excessive application of animal wastes and releases of leachate and wastes from landfills can effect changes in existing soil classification	Medium

5.5 Landscape and Biodiversity

The value, vulnerability and sensitivity of the environmental receptors for this topic are shown in Table 5-5.

Table 5-5: Sensitivity of receptors for Landscape and Biodiversity

Receptor	Value	Vulnerability		Sensitivity		Vulnerability		Sensitivity		Vulnerability	
Receptor	**Value**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**
Protected Landscapes	High – protected landscapes are an important resources for visual amenity and unique landscapes character	High - Height of turbines, large land-take and ancillary development could directly affect protected landscapes, their setting and peoples experience of these landscapes	High	High - Large land-take could directly affect protected landscapes, their setting and peoples experience of these landscapes	High	High Introduction of reservoirs and dams could directly affect protected landscapes, their setting and peoples experience of these landscapes	High	High - Height of boiler buildings and large land-take could directly affect protected landscapes, their setting and peoples experience of these landscapes	High	High Large land-take could affect protected landscapes, their setting a and peoples experience of these landscapes	High
Protected Biodiversity Areas	High – Protected biodiversity sites are internationally, nationally and regionally important areas of natural	High - Land take and ancillary development could lead to permanent footprint losses fragmentation of habitats	High	High - Land take and ancillary development could lead to permanent footprint losses, fragmentation and	High	High - Damming of watercourses could lead to hydrological and geomorphologic changes in	High	High - Land take and ancillary develop could lead to permanent footprint losses fragmentation of habitats	High	High - Land take and ancillary develop could lead to permanent footprint losses fragmentation of habitats	High

Receptor	Value	Vulnerability		Sensitivity		Vulnerability		Sensitivity		Vulnerability	
Receptor	**Value**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**
	habitat, supporting rare, endangered species or large populations of migratory species.	and sites and direct mortality to species supported by sites (i.e. birds, bats)		simplification of habitats and sites.		water dependent protected sites.		and sites. Increased transportation may lead to increased levels of disturbance.		and sites. Increased transportation may lead to increased levels of disturbance.	
Aquatic Ecosystems	High –Aquatic systems are important to maintain natural aquatic conditions and maintain wildlife corridors	Low – Limited vulnerability; aquatic systems could be affected by stormwater runoff, particularly during construction	Medium	Low – Limited vulnerability; aquatic systems could be affected by stormwater runoff, particularly during construction	Medium	High – Construction and operation of hydro facilities can have significant, long-term effects on aquatic ecosystems	High	Medium – Water withdrawals and wastewater discharges can have local and regional scale impacts on affected water bodies and hydrological networks.	Medium	Medium – Water withdrawals and wastewater discharges can have local and regional scale impacts on affected water bodies and hydrological networks.	Medium
Protected Species	High – Rare or endangered species and/or important migratory species such	High – Potential for loss of breeding, roosting, foraging or loafing	High	High – Land take and ancillary development could lead to permanent footprint	High	High - Direct impact on protected migratory fish species mortality	High	High - Land take and ancillary development could lead to permanent	High	High - Large land and ancillary develop could lead to permanent footprint	High

Receptor	Value	Vulnerability		Sensitivity		Vulnerability		Sensitivity		Vulnerability	
Receptor	**Value**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**
	as those species cited under the Bern Convention Appendix II	habitat due to potential for direct mortality to airborne migratory species, such a birds or bats in the course of migration or foraging behaviour.		losses fragmentation and simplifications of regulated and unregulated habitats and site.		and barriers to migration. There may be indirect effects on piscivorous protected species upstream and downstream.		footprint losses fragmentation of habitats and sites. Associated improvements to the transport network and increased traffic movements have the potential to disrupt migratory species (i.e. bats) and increase disturbance.		losses fragmentation of habitats and sites. Associated improvements to the transport network and increased traffic movements have the potential to disrupt migratory species (i.e. bats) and increase disturbance.	
High quality unregulated landscapes (Undisturbed natural landscape, traditionally managed & scenic and historic towns/villages	High - a number and limited area of landscape types remain undisturbed by human activity examples being original steppe, areas	High - height of turbines will affect landscape character and visual amenity	High	High - large land-take could affect landscape character and visual amenity	High	High - land-take in combination with new power houses and dams could affect landscape character and visual	High	High - height of structures and large-land-take could affect landscape character and visual amenity	High	Medium - large land-take is associated with landfill sites which would not be undisturbed land	Medium

Receptor	Value	Vulnerability		Sensitivity		Vulnerability		Sensitivity		Vulnerability	
Receptor	**Value**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**
/features)	of forest and alpine meadow, notably in the Carpathians and Crimea					amenity.					
Low quality landscapes (Degraded and or intensively used landscapes, typically intensive arable, intensive livestock units, industrialised and urban landscapes)	Low – large tracts of Ukraine have been converted to croplands, the landscape is common.	High – height of turbines will affect landscape character and visual amenity	Medium	Medium - generally facilities are low lying. Large land-take could affect landscape character and visual amenity	Medium	High - land-take in combination with new power houses and dams could affect landscape character and visual amenity.	Medium	High – height of structures, large-land-take could affect landscape character and visual amenity	Medium	Medium - large land take is associates with landfill sites which would not generally be considered to be high quality landscapes.	Medium
Unprotected remnant natural ecosystems	High – rare undisturbed ecosystems such as: •Forest •Yaila and meadows •Steppe grassland •Steppe	High – Land take of remnant undesignated natural habitats.	High	High - Footprint losses of remnant undesignated natural habitats.	High	High - land-take in combination with new power houses and dams could affect landscape character	High	High - height of structures and large-land-take could affect landscape character and visual amenity	High	Medium - large land-take is associated with landfill sites which would not be undisturbed land	Medium

Receptor	Value	Vulnerability		Sensitivity		Vulnerability		Sensitivity		Vulnerability	
Receptor	**Value**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**
	savannah •River corridors					and visual amenity.					
Unprotected adapted ecosystems	Low – ecosystems adapted to widespread intensive land use such as croplands and urban/rural fringes	Low– Land take of undesignated adapted habitats.	Low	Low - Land take of undesignated adapted habitats.	Low	Low - Land take of undesignated adapted habitats.	Low	Low - Land take of undesignated adapted habitats.	Low	Low - Land take of undesignated adapted habitats	Low

5.6 Community and Socio-economics

The value, vulnerability and sensitivity of the environmental receptors for this topic are shown in Table 5-6.

Table 5-6: Sensitivity of receptors for Community and Socio-economics

		Wind (onshore)		Solar PV		Small Hydro		Biomass		Biogas	
Receptor	**Value**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**
Demographics	High – communities are very sensitive to disruptions due to possible resettlement and/or economic dislocation	Low – Possible vulnerability if transmission lines cross through settlements. Possible temporary economic dislocation.	Medium	Medium – Possible economic dislocation from loss of economic use of lands during installation and operation of schemes to utilise solar resources Potential for resettlement is low Possible vulnerability if transmission lines cross through settlements	Medium	Medium– possible installation of schemes to utilise small hydro resources may require economic relocation, for facilities and transmission lines	Medium	Medium– human settlements may be affected by installation of schemes to utilise biomass resources Possible vulnerability if transmission lines cross through settlements	Medium	Low – demographics will not be affected by installation of schemes to utilise biogas resources, as these are to be cited at existing landfills and feedlots Possible vulnerability if transmission lines cross through settlements	Medium
Health	High – human health is	Low – possible	Medium	Medium Possible	Medium	Medium – Hydropower	Medium	Medium – decrease in	Medium	Low - Possible	Medium

		Wind (onshore)		Solar PV		Small Hydro		Biomass		Biogas	
Receptor	**Value**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**
	critical for successful development	disturbances to local populations from noise, and dust during construction and use of access roads, and power transmission lines for servicing during operation. Potential for noise disruptions during operation of turbines Possible negative impacts if homes too close to power lines		negative impacts if homes are too close to power lines. Possible negative impacts during grating and construction from dust and noise		direct impacts on human health include noise, dust, and vibration during construction of facilities and transmission lines. Noise may be disruptive from power lines. Possible negative impacts if homes too close to power lines		burning of fields will have positive impact on human health Possible negative impacts if homes too close to power lines		negative impacts if homes too close to power lines	
Employment/ Earning	High – employment is critical for future development	Low – installation and maintenance favourable	Medium	Low – installation and maintenance favourable	Medium	Low – installation and maintenanc e favourable	Medium	Low – installation and maintenance favourable	Medium	Low – installation and maintenance favourable for	Medium

		Wind (onshore)		Solar PV		Small Hydro		Biomass		Biogas	
Receptor	**Value**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**
	and stability	for some employment and income for local residents		for employment and earnings		for employment and earnings		for employment and earnings		employment and earnings	
Economic Sectors	High – sectoral development necessary to maintain balanced development	Low – improved energy reliability positive for economic development	Medium	Low – Potential loss of agricultural lands, improved energy reliability positive for economic development	Medium	Low – Short term disruption of irrigation possible, improved energy reliability positive for economic development, Potential reduction in flooding damages	Medium	Low – improved energy reliability positive for economic development	Medium	Low – Possible small economic dislocation due to power lines improved energy reliability positive for economic development	Medium
Infrastructure	High – importance of infrastructure for reliable development	Medium - Increase demand on roadways and bridges during construction of windfarms and power transmission lines Increase in	Medium	Low Increase demand on roadways and bridges during construction of facilities and power transmission lines Increase in	Medium	Medium Increase in energy availability and access to energy on transmission network, short term increase in traffic during	Medium	Medium Increase in energy availability and access to energy on transmission network, short term increase in traffic during installation	Medium	Medium Increase in energy availability and access to energy on transmission network,	Medium

		Wind (onshore)		Solar PV		Small Hydro		Biomass		Biogas	
Receptor	**Value**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**
		energy availability and access to energy on transmission network		energy availability and access to energy on transmission network		installation Increase demand on roadways and bridges during construction of facilities and power transmission lines		and operation			
Tourism and Environmental Amenities	Low – tourism based on environmental amenities currently remains underdeveloped, perception of degradation in Ukraine	Low – positive for environmental image and ecotourism potential, negative if power lines disrupt vistas	Low	Low – positive for environmental image and ecotourism potential, Possible loss of visual amenities	Low	Medium for possible disruption of surface water enjoyed for tourism and environmental amenities	Medium	Medium – positive for environmental image and ecotourism potential	Medium	Low for Possible loss of visual amenities due to power transmission lines	Low

5.7 Cultural Heritage

The value, vulnerability and sensitivity of the environmental receptors for this topic are shown in Table 5-7.

Table 5-7: Sensitivity of receptors for Cultural Heritage

		Wind (onshore)		Solar PV		Small Hydro		Biomass		Biogas	
Receptor	**Value**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**
UNESCO World Heritage Sites and sites on the UNESCO Tentative List	High	Medium – it is unlikely that new development will directly affect these sites.	High	Medium – it is unlikely that new development will directly affect these sites.	High	Medium – it is unlikely that new developmen t will directly affect these sites.	High	Low – None (existing landfill). It is unlikely that new developmen t will directly affect these sites.	Medium	Low – None It is unlikely that new development will directly affect these sites.	Medium
Registered cultural heritage sites.	High – Low[75]	Medium – High. There is potential for new development to affect	Medium - High	Medium – given southern areas of solar potential.	Medium - High	Medium – High - cultural heritage sites often associated	Medium - High	Low – None (existing landfill). It is unlikely that new developmen	Medium - None	Medium – None (existing landfill). It is unlikely that new	High - None

[75] Cultural heritage sites represent a range of values. UNESCO designated sites are of international importance and those on the Tentative are of the highest national, if not international importance. Registered Ukrainian Cultural Heritage Sites range from national to local importance, whereas unknown sites could be of any value, including international significance. The known cultural heritage resource is generally in a stable condition, if it is protected according to law. However, unknown sites are vulnerable to development pressures which may damage or erode them. Larger scale development, such as that posed by wind farms may change the cultural setting of sites. Areas that are likely to be rich in heritage sites are associated with rivers, hilltops, plains and the coast which are favourable for human settlement, agriculture, nomadism and fortification. These areas are vulnerable to wind, solar and small hydro-development. Existing landfills are unlikely to have any cultural heritage value and few or no pathways exist. However, agricultural areas to support biogas and biomass are likely to have a history of occupation, although the heritage resource may have already been eroded due to previous intensive agricultural practices. Intangible cultural heritage is less sensitive to changes from development under the renewable scenarios, mainly because they are location specific and would not involve changes to communities. However, this should be reviewed at a local level where there may be specific places or practices which are affected.

		Wind (onshore)		Solar PV		Small Hydro		Biomass		Biogas	
Receptor	**Value**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**	**Vulnerability**	**Sensitivity**
		these receptors, given scale and locations of developments				with rivers but small scale of development would limit pathways.		t will directly affect these sites.		development will directly affect these sites.	
Unknown or unregistered cultural heritage sites	High – Low[37]	High – these sites are unknown and large scale upland development is likely to affect	Medium - High	Medium – given southern areas of solar potential.	Medium - High	Medium – High- cultural heritage sites often associated with rivers but small scale of development would limit pathways.	Medium - High	Low – None (existing landfill). It is unlikely that new development will directly affect these sites.	Medium - None	Medium – None (existing landfill). It is unlikely that new development will directly affect these sites.	High - None
Intangible cultural heritage	High – Low[37]	Low – Unlikely to cause cultural changes, although this should be reviewed on a local level, e.g. upland grazing practices	Medium-Low	Low – Unlikely to cause cultural changes, although this should be reviewed on a local level.	Medium - Low	Low – Unlikely to cause cultural changes, although this should be reviewed on a local level	Medium - Low	Low – Unlikely to cause cultural changes, although this should be reviewed on a local level.	Medium - Low	Low – Unlikely to cause cultural changes, although this should be reviewed on a local level.	Medium - Low

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6. APPENDICES

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Appendix A: Programmes and Other Strategic Documents relevant to the USELF SER Project

N	Oblast (region)	Title of the programme and link	Summary
1	**Crimean Peninsula**	*The 2010-2014 Energy Saving Programme for the Autonomous Republic of Crimea* http://minenergy.ark.gov.ua/o-reskomitete/-docs/92-programma-energosberezheniya-v-ar-krym-na-2010-2014-gg.html	One of the Programme's sections is dedicated to measures designed to maximise utilisation of RES's energy generation potential in order to conserve traditional energy resources so much needed for the stable operation of regional industries, social facilities, budget entities and municipal utilities. The Programme provides the list of facilities where solar, wind and small hydro power generation equipment can be installed, and facilities where biogas-fired cogeneration units can be used. It also sets development/utilisation targets for each of the renewable energy sources considered. As can be seen from the above, the 2010-2014 Crimean Republic Energy Saving Programme sets out the strategy for renewable energy development in Crimea, identifies the most promising renewable energy options and offers specific mechanisms for restructuring the region's fuel and energy sector through the introduction of renewable energy systems.
		The 2011-2020 Economic and Social Development Strategy for the Autonomous Republic of Crimea http://www.ark.gov.ua/images/strategiya2011-2020new-5.pdf	The Strategy comprises a separate section that specifically focuses on the transition toward a more sustainable energy consumption pattern in the Crimea, to be based on the optimised use of local energy sources that can be achieved through the development/utilisation of renewable energy resources (wind, solar, biomass) and alternative fuels (bio-ethanol, biogas, solid biofuel and biodiesel).
2	**Odessa Oblast**	*The 2011-2014 Odessa Oblast Industrial Development Programme* *http://gue.odessa.gov.ua/Main.aspx?sect=Page&IDPage=31506&id=106*	As one of the main development priorities for industrial sector in the Odessa Oblast, the Programme identifies the introduction and application of environmentally safe energy- and resource-saving technologies; use of alternative energy resources; and development of new modern industrial facilities across the Oblast that will use energy generated from renewable sources. The following tasks have been identified for 2011-2014: the construction of biofuel and feed milling plant in Kodyma; construction of wood-based solid biofuel production plant in Balta; construction of bio-ethanol plant at the PivdenRemVerstat Repair Plant in the Borschi Village (Kotovsk District); pellet fuel manufacture from wood residues and agricultural waste in the Antoniuky Village (Mykolaivka District); manufacture of straw and sawdust fuel in the Savran Settlement; restoration and launch of small hydropower plant in the Savran Settlement; pellet fuel manufacture from animal husbandry waste in the Shiryaevo Settlement; and construction of municipal solid waste sorting/recycling plant in Kotovsk.

N	Oblast (region)	Title of the programme and link	Summary
			To summarise the above, the 2011-2014 Odessa Oblast Industrial Development Programme anticipates the development of renewable energy in the region – first and foremost, through the construction and operation of specialised biofuel manufacturing facilities.
		The 2010-2015 Integrated Programme for the Sustainable Development of Northern Areas in the Odessa Oblast http://gue.odessa.gov.ua/Main.aspx?sect=Page&IDPage=21535&id=106	One of the results the Programme is expected to achieve is reducing the cost of energy and fuel through the development of 3 straw pellet plants; upgrade and repair of heating systems at 15 social service facilities; and construction of bio-ethanol plant in the northern area of Odessa Oblast by the end of 2015.
		The 2010-2014 Odessa Oblast Regional Energy Efficiency Programme http://oblrada.odessa.gov.ua/Main.aspx?sect=Page&IDPage=29292&id=462	The Programme aims to facilitate the implementation of energy-saving measures based on the use of alternative and renewable energy sources. A significant emphasis is placed upon the need to mobilise foreign investment. The Programme provides an overview of potential alternative/renewable energy sources in Odessa Oblast, including solar power, small hydropower, biomass, wind power, wastewater thermal energy recovery etc. The Programme contains a list of concrete actions designed to support and promote the use of alternative energy across the Oblast, where considerable focus is placed upon the development of wind energy, solar energy and bio-energy. The following priority areas for renewable energy development are identified in the Programme: the development of alternative energy sources (including the installation of 66 wind turbines with a total capacity of up to 200 MW in the Ovidiopol and Tatarbunar Districts); use of local fuels (the Programme describes a number of pilot projects involving the installation and operation of equipment for manufacturing pellet fuel from straw and grapevine); use of cogeneration units.
3	**Donetsk oblast**	*The 2010-2015 Donetsk Oblast Energy Efficiency Programme* http://www.donoda.gov.ua/main/ua/publication/content/7718.htm	The development of alternative energy sources in the Donetsk Oblast is one of the main objectives identified in the 2010-2015 Donetsk Oblast Energy Efficiency Programme. The document provides an overview of the Oblast's renewable energy potential, including wind energy, solar energy, biomass, small hydropower etc. The Programme comprises a section with the analysis of energy efficiency measures implemented in the Donetsk Oblast in 2006-2009. It also identifies the priorities for development and utilisation of

N	Oblast (region)	Title of the programme and link	Summary
			alternative/renewable energy sources, and provides the list of planned pilot projects aiming to demonstrate the benefits of using recovered energy resources, wind and solar energy, and biomass. Speaking of wind energy, the Programme anticipates the completion of a 120 MW wind power plant in Novoazovsk, and construction of wind farms with a total capacity of 700 MW in the Volodarsk and Pervomaisk Districts. The plans for the solar energy development include the construction of a solar photovoltaic plant and installation of solar collectors in the budget entities. The Programme has a suite of annexes detailing planned measures, financing arrangements, and comparative assessment of the Oblast's renewable energy potential for selected renewable energy sources relative to other Oblasts in Ukraine.
4	**L'viv oblast**	*The 2010-2014 Ternopil Oblast Energy Efficiency and Energy Saving Programme*	One of the tasks identified in the L'viv Oblast Development Strategy until 2015 (http://www.loda.gov.ua/content/files/2015.pdf) is the development and implementation of energy saving and renewable energy programmes. To this end, L'viv Oblast has three ongoing programmes in the field of energy saving and energy efficiency: *- 2009-2012 L'viv Oblast Household Energy Saving Programme,* *- 2010-2015 L'viv Oblast Budget Entity Energy Saving Programme,* *- 2010-2015 L'viv Oblast Municipal Utility Energy Saving Programme.* While each of the Programmes characterises the energy generation potential of renewable energy sources available in the Oblast, describes examples of existing renewable energy facilities, identifies development priorities for renewable energy sector, none of them offers concrete actions toward maximising the use of renewable energy potential. The potential for wind energy development is considered to be sufficiently; according to the survey results, the most promising wind energy resources are concentrated in the Drohobych, Skole and Turka Districts. The use of biofuels is considered to be feasible on the local scale, i.e. to meet the energy needs of individual enterprises and organisations. Some biomass technologies (e.g. straw pellets and use of wood processing residues as a fuel) have already been introduced into practice. As regards the small hydropower potential, the Oblast ranks second in Ukraine. The design development process is underway for an 1.2 MW mini hydropower plant at the Dobrotvorska TPP water management facility site and Skolivsky wind power plant. The potential siting options have been identified for the following

N	Oblast (region)	Title of the programme and link	Summary
			small hydropower plants: Starosambirska SHPP (the Dniester River), Khirovska SHPP (the Striy River), Opirska SHPP (the Opir River), and Novoshpytska SHPP (the Bystrytsia River).
5	**Ternopil oblast**	*The 2010-2014 Ternopil Oblast Energy Efficiency and Energy Saving Programme* http://www.obl-rada.te.ua/dokumenty/oblasni-prohramy	The draft 2011-2015 Ternopil Oblast Small Hydropower Development Programme has been approved to facilitate the development of small hydropower and maximise the economically viable use of small hydropower potential, enhance the management and safety performance of small hydropower plants, and increase the regulating/storage capacity of small hydropower plants. The Programme anticipates the construction of 6 small hydropower plants and upgrade of existing facilities, installation of 19 solar collectors and 11 wind power units.
6	**Zakarpattia Oblast**	*Zakarpattia Oblast Integrated Water Resource Management Programme* http://www.carpathia.gov.ua/ua/publication/content/4390.htm	The *Zakarpattia Oblast Integrated Water Resource Management Programme* was adopted at the recent session of the Zakarpattia Oblast Council on 07.04.2011. The implementation process is planned to include two phases as follows: the development and approval of the integrated water resource management plan for the Oblast (Phase 1), and construction of pumped storage plants, regulating reservoirs and hydropower plants with the use of investment funding (Phase 2). The plan anticipates the construction of a chain of mini-HPPs (5 to 20 MW) on the Tisa River tributaries.
7	**Chernivtsi Oblast**	http://zaxid.net/newsua/2009/2/10/90016/	The Chernivtsi Oblast State Administration has identified 8 sites in the Vyzhnytsia, Putyla, Hlyboka and Storozhynets Districts for the construction of small hydropower plants, and 10 sites for future wood pellet plants.
8	**Dnipropet-rovsk Oblast**	*The 2010-2015 Dnipropetrovsk Oblast Energy Efficiency and Energy Saving Programme* http://oblrada.dp.ua/official-records/decisions/0/445	The Programme states that the development and use of renewable energy resources, including solar and wind energy, small hydropower, thermal energy recovered from industrial processes, geothermal energy, bio-energy and other alternative energy options. In addition, the Programme includes a provision for the development of local capacity for large-scale manufacture of wind power units.

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Appendix B: KEY International Legal Acts Related to Environmental Protection and to which Ukraine is a Party

Source: http://epl.org.ua/en/legislation/international/

International document	Date of adoption	Date of entry into force	Date of ratification/ accession by Ukraine
Antarctic Treaty	01.12.1959	23.06.1961	17.09.1992
Convention concerning the Protection of Workers against Ionising Radiations	22.06.1960	17.06.1962	05.08.1967
International Convention for the Protection of New Varieties of Plants	02.12.1961	10.08.1968	02.06.1995
Vienna Convention on Civil Liability for Nuclear Damage	21.05.1963	12.11.1997	12.07.1996
International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties	29.11.1969	06.05.1975	17.12.1993
Convention on Wetlands of International Importance especially as Waterfowl Habitat (commonly known as the 'Ramsar Convention')	02.02.1971	21.12.1975	29.10.1996
Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage	18.12.1971	16.10.1978	25.05.1980
Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction	10.04.1972	26.03.1975	26.03.1975
Stockholm Declaration on the Human Environment	16.06.1972		
Convention for the Protection of World Cultural and Natural Heritage	16.11.1972	17.12.1975	04.10.1988
Convention concerning the Prevention of Marine Pollution by Dumping of Waste and Other Materials	29.12.1972	30.08.1975	17.12.1993
Convention on International Trade in Endangered Species of Wild Fauna and Flora	03.03.1973	01.07.1975	30.12.1999
Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques	10.12.1976	05.10.1978	16.05.1978

International document	Date of adoption	Date of entry into force	Date of ratification/ accession by Ukraine
Convention on Future Multilateral Cooperation in the Northwest Atlantic Fisheries	24.10.1978	01.01.1979	06.07.1999
Convention on the Conservation of Migratory Species of Wild Animals (commonly known as the 'Bonn Convention')	23.06.1979	01.11.1983	19.03.1999
Convention on the Conservation of European Wildlife and Natural Habitats (commonly known as the 'Bern Convention')	19.09.1979	01.06.1982	29.10.1996
Convention on Long-range Transboundary Air Pollution	13.11.1979	16.03.1983	05.06.1980
Convention on the Physical Protection of Nuclear Material	03.03.1980	08.02.1987	06.07.1993
Convention on the Conservation of Antarctic Marine Living Resources	20.05.1980	07.02.1982	04.02.1994
World Charter for Nature	01.01.1982		
UN Convention on the Law of the Sea	10.12.1982	16.11.1994	03.06.1999
Vienna Convention for the Protection of the Ozone Layer	22.03.1985	22.09.1989	20.05.1986
Protocol on the Reduction of Sulphur Emissions or Their Transboundary Fluxes by at Least 30 Percent to the Convention on Long-range Transboundary Air Pollution	08.07.1985	02.09.1987	12.08.1986
Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency	26.09.1986	26.02.1987	26.01.1987
Convention on Early Notification of a Nuclear Accident	26.09.1986	27.10.1986	30.12.1986
Montreal Protocol on Substances that deplete the Ozone Layer	16.09.1987	01.01.1989	20.09.1998
Convention for the suppression of Unlawful Acts against the Safety of Maritime Navigation	10.03.1988	01.03.1992	17.12.1993
Protocol for the Suppression of Unlawful Acts against the Safety of Fixed Platforms Located on the Continental Shelf	10.03.1988	07.01.2002	17.12.1993
Protocol concerning the Control of	01.11.1988	14.02.1991	24.07.1989

International document	Date of adoption	Date of entry into force	Date of ratification/ accession by Ukraine
Emissions of Nitrogen Oxides or their Transboundary Fluxes to the Convention on Long-range Transboundary Air Pollution			
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal	22.03.1989	05.05.1992	01.07.1999
Convention on Environmental Impact Assessment in a Transboundary Context (commonly known as the 'Espoo Convention')	25.02.1991	10.09.1997	19.03.1999
Agreement on the Conservation of Populations of European Bats (commonly known as EUROBATS)	04.12.1991	06.01.1994	14.05.1999
Convention on the Protection and Use of Transboundary Watercourses and International Lakes (commonly known as the 'Water Convention')	17.03.1992	06.10.1996	01.07.1999
Convention on the Protection of the Black Sea Against Pollution	21.04.1992	15.01.1994	04.02.1994
United Nations Framework Convention on Climate Change	09.05.1992	21.03.1994	29.10.1996
Rio Declaration on Environment and Development	03.06.1992		
Convention on Biological Diversity	05.06.1992	29.12.1993	29.11.1994
Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on Their Destruction	13.01.1993	29.04.1997	16.10.1998
Protocol on the Further Reduction of Sulfur Emissions to 1979 Convention on Long-range Transboundary Air Pollution	14.06.1994	05.08.1998	17.12.1996
Convention on Nuclear Safety	20.09.1994	07.07.1998	17.12.1997
Agreement for Conservation of African-Euroasian Migratory Waterbirds	16.06.1995	01.11.1999	04.07.2002
Agreement for the Implementation of the Provisions of the Convention relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks	04.12.1995	11.12.2001	28.11.2002

International document	Date of adoption	Date of entry into force	Date of ratification/ accession by Ukraine
Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management	05.09.1997	18.06.2001	20.04.2000
Kyoto Protocol to United Nations Framework Convention on Climate Change	11.12.1997	16.02.2005	04.02.2004
Protocol on Persistent Organic Pollutants to 1979 Convention on Long-range Transboundary Air Pollution	24.06.1998	23.10.2003	
Heavy Metals Protocol to the 1979 Convention on Long-range Transboundary Air Pollution	24.06.1998	29.12.2003	
Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (commonly known as the 'Aarhus Convention')	25.06.1998	30.10.2001	06.07.1999
Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade	10.09.1998	24.02.2004	26.09.2002
Protocol on Water and Health to the 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes	17.06.1999		
Protocol on Liability and Compensation for Damage Resulting from Transboundary Movements of Hazardous Wastes and their Disposal	10.12.1999		
Cartagena Protocol on Biosafety to the Convention on the Biodiversity	29.01.2000	11.09.2003	12.09.2002
Stockholm Convention on Persistent Organic Pollutants	22.05.2001	17.05.2004	
Protocol on Strategic Environmental Assessment (SEA) to the 'Espoo Convention'.	21.05.2003	11.10.2010	11.07.2011

Appendix C: Websites Consulted, Documents and Publications Cited, and GIS Sources Utilised During the Preparation of the Environmental Topic Paper

Websites consulted during preparation of this Environmental Topic Paper include:

- The website of the Ministry of Environmental Protection containing information regarding the protected areas and species, biodiversity, and landscapes of Ukraine (http://menr.gov.ua/);
- Data on geology and hazardous exogenic geological processes were derived from the national reports of the Ministry of Emergency Situations (http://mns.gov.ua/);
- Protected Area and Key Biodiversity Area data was downloaded from the Integrated Biodiversity Assessment Tool (IBAT) (http://www.ibatforbusiness.org). Provided by BirdLife International, Conservation International, IUCN and UNEP-WCMC (contact ibat@birdlife.org for further information);
- Internet sources such as, Water Profile (http://www.eoearth.org/article/Water_profile_of_Ukraine) and Energy Profile http://www.eoearth.org/article/Energy_profile_of_Ukraine). WikiWater and Wikipedia also informed the description of current baseline conditions and trends;
- Socio-economic and cultural data were obtained from the website of the Ministry of Statistics of Ukraine (http://ukrstat.gov.ua/), the website of International Councils of Monuments and Sites (http://www.international.icomos.org /risk/2001/ukra2001.htm) and the website of Compendium of Cultural Policies and Trends in Europe (http://www.culturalpolicies.net/web/ukraine.php), and " Chernobyl's Legacy: Health, Environmental and Socio-Economic Impacts and Recommendations to the Governments of Belarus, the Russian Federation and Ukraine" The Chernobyl Forum: 2003-2005, Second Revised Version (http://www.iaea.org/Publications/Booklets/Chernobyl/chernobyl.pdf) Accessed 14 April 2011;
- The World Wildlife Fund (WWF) website was used to develop ecoregion descriptions (http://www.worldwildlife.org /science/ecoregions/WWFBinaryitem4810.pdf);
- The National Agency for Environmental Investments website for information on greenhouse gas emissions (http://neia.gov.ua/nature/control/uk/index);
- The UND-Dnipro Basin. Transboundary Diagnostic Analysis of the Dnipro River Basin (http://www.dnipro-gef.net/first_stage/projects-reports/transboundary-diagnistic-analysis-1/transboundary-diagnistic-analysis-of-the-dnipro-river-basin?set_lengauage=en);
- Dnieper River (www.history.com/topics/dnieper-river);
- Freshwater Ecoregions of the World: 425: Dnieper – South Bug (www.feow.org);
- Earth's Endangered Creatures – various fish species (www.earthsendangered.com);
- Information on various fish species (www.fishbase.org);
- Information on various fish species (www.iucnredlist.org);

- Information on various fish species (data.gbif.org);
- List of freshwater fishes for Ukraine (www.mongabay.com);
- Information on the Dniester River (www.dniester.org); and,
- Information on hydropower and energy production (http://www.enercee.net/ukraine/energy-sources.html).

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- "Environment of Ukraine: Statistics" (Ministry of Statistics of Ukraine: 2009);
- "Ukraine in Figures: Statistics" (Ministry of Statistics of Ukraine: 2010);
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- "The Fifth National Notification on Climate Change - Preparation to implement Articles 4 and 12 of the Framework UN Convention on Climate Change, and Article 7 of the Kyoto protocol". (Ministry of Environmental Protection of Ukraine, Ministry of Emergencies of Ukraine; National Academy of Science of Ukraine, Scientific Research Institute of Hydrometeorology: 2009);
- "National Report of the State of Technogenic and Environmental Safety in Ukraine" (Ministry of Emergencies of Ukraine: 2009);
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Several Geographic Information System (GIS) data sources have also been utilised to compile the mapping information within this report. The relevant sources are:

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