Assessment of landscape sensitivity - from region to site

Concept and scale of application with worked examples Simon Bell

Landscape Sensitivity and Landscape Capacity: common approach

Landscape sensitivity

- Reflects the vulnerability of a landscape to change; the ability of a system to take pressure
- Within a landscape, certain attributes may be more vulnerable to change than others

Landscape Sensitivity and Landscape Capacity: common approach

Landscape capacity

- The ability of a landscape character type or area to accommodate a specific change without undesired effects, influenced by landscape sensitivity
- Varies according to the type and degree of change
- Reflects the value of the landscape

Landscape Sensitivity and Landscape Capacity: common approach

The landscape is *sensitive* to different forms of recreation and tourism activities.

Capacity is the ability by which the landscape can accommodate a particular type or scale of activity in relation to its sensitivity.

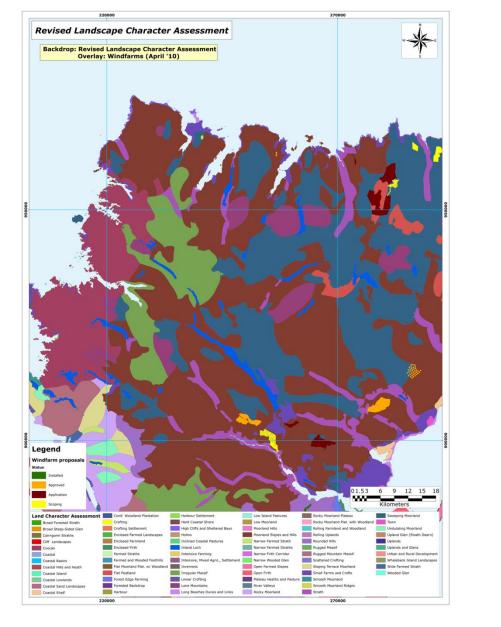
Thus a landscape with *greater sensitivity* to a particular type of development usually has *lower capacity* to accommodate this.

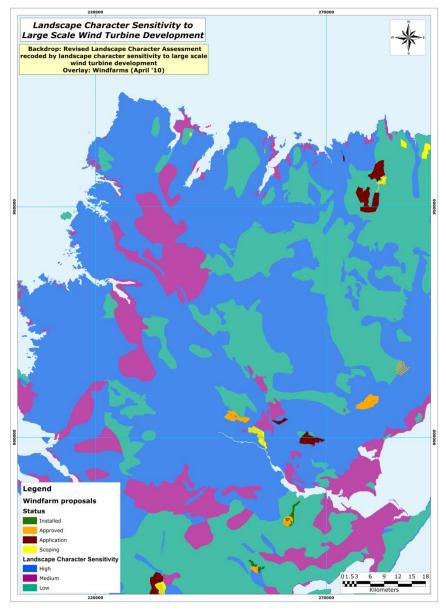
Planning for new large-scale developments

- Landscape character can be used to identify places where the sensitivity of the landscape and thus its "capacity" to accept certain types of new development need to be evaluated
- Wind energy developments are one example.

Landscape character sensitivity for onshore wind turbine development in the Scottish Highlands

- A project undertaken for Highland Council and Scottish Natural Heritage (now NatureScot)
- Carried out by David Miller of the James Hutton Institute and Simon Bell.
- Used the Scottish landscape character assessment as a basis
- Used specific criteria to assess sensitivity in GIS





Areas of landscape character and their sensitivity for wind farm development in northern Scotland

Landscape Capacity: Recreation

- For recreation planning sensitivity may include all dimensions in relation to winter/summer, land/water, active/passive, motorised/non-motorised forms of recreation and tourism etc
- Capacity may be measured in terms of which forms of activity are most suitable for a specific LCA: in some, lowkey hiking on nature trails may be all that is possible while in others ATVs may be acceptable.

Assessing Landscape Sensitivity

As the sensitivity of a landscape to a specific development is influenced by landscape character, it is affected by aspects such as:

- Visual/experiential
- Hydrology,
- Soils,
- Ecology: habitats, wildlife
- Historical, social and cultural aspects

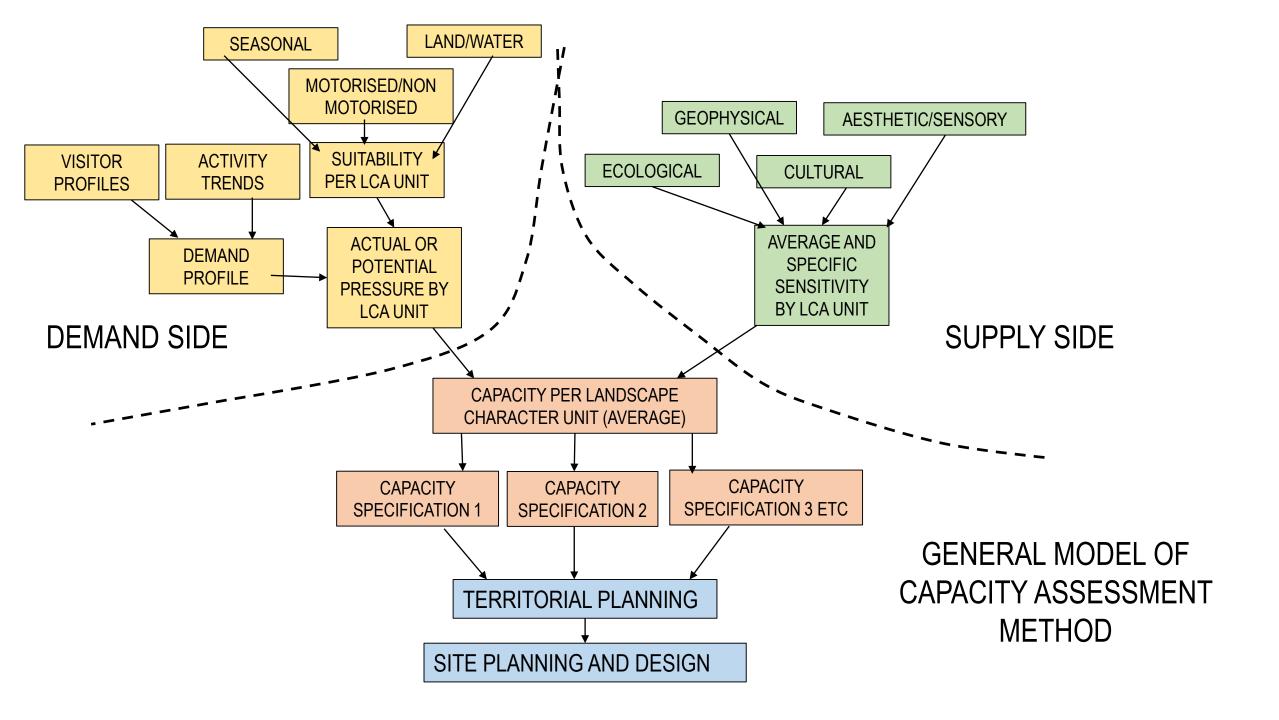
Assessing Landscape Sensitivity

Criteria need to be developed to assess each aspect of sensitivity in relation to the type of proposed development

- The criteria can be assessed along **a defined scale**, for example qualitatively as high, medium or low, or numerically on a scale of, for example, 1-5, but the rationale and definition of different levels on a scale must be absolutely clear
- Each LCA unit (individual units and/or combinations of units) is assessed for sensitivity in relation to the specific type of development proposed

Assessing Landscape Capacity

- In order to assess capacity, it is necessary to assess each LCA unit as to its suitability for the potential development type (eg recreation type), including consideration of landscape value. This can also be assessed on a scale as for sensitivity.
- To consider capacity for the potential development type, it is necessary to categorise the different types of development that may be proposed and to assess the varying capacity for these, for example different kinds of recreation at different seasons. In some places, there may be pressure for different types of development in different LCA units.



The LCA-units (Landscape Character Assessment Units) used in this task are the result of Phase II in Outdoor recreation planning & design, where a Landscape Character Assessment of the area was done. The landscape were studied and divided into 13 units.

 (\mathbf{r})

Vast horizontal fields
 Rolling cultivated landscape
 Manor landscape
 Mosaic landscape

5. Pine pillar forest
 6. Flat mixed forest
 7. Rolling mixed forest
 8. Meandering river banks
 9. Mire landscape

9

9. Mire landscape
 10. Industrialized wetland
 11. Meandering sandy banks
 12. Dolostone quarry
 13. Settlements

5

Assessing suitability and/or pressure: demand side

- Consider the suitability of each LCA for different forms of recreation: seasons, water/land, motorised/non/motorised
- Take into account what is there already and its condition, scale of provision etc
- What is the actual or potential demand?
- Who might the user groups/target market be?
- Assess the pressure (or if no specific pressure then the suitability should demand build up in future)

Winter/Land	Summer/land	Winter/water	Summer/water
snowman building	cycling/longboarding	ice skating	sandcastle building
skiing	foraging/gathering	ice fishing	canoeing
sleigh	mountain bike	ice bathing	swimming
husky stedee	tree climbing	kick sledge	fishing
zorbing	agritourism	sauna	aguagym
horse sledge-	voga/meditation	snowmobile	pedalboat
sauna	hot air balloon	hunting	paddle boarding
snowmobile	kite flying	ice drifting	boediving
hunting	climbing	skiine	sauna
social event	fosil searching	sledding	spa
open-air theatre	skydiving	husky sledging	motorboating
lightshow	zorbing	stargazing	childrens' play
animal park	disceolf	drone flying	birdwatching
picnicking	plenicking		fishing
kick sledge	birdwatching		educational activities
nature trekking	bosshoeing		
nature hiking	sauna		
motorcross/rally	motorcycling		
voga/meditation	motocross/rally		
childrens' play	open-air theatre		
wildlife photography	paintball		
stargazing	adventure park		
educational activities	minigolf		
cabin camping	golfing		
drone flying	bmx tracks		
sight seeing	skateboarding		
orienteering	horse carriage		
	orienteering		
	nature trekking		
	hiking		
	childrens' play		
	social event		
	animal park		
	horsebackriding		
	hunting		
	camping/ cabin camping		
	wildlife photography		
	stargazing		
	educational activities		
	arts and crafts		
	drone flying		
	sight seeing		

Example of suitability (not divided into motorised/nonmotorised, which could be a problem)

Suitability : winter/land map

This map shows the suitability of the different units for winter/land activities, for example snowman building, skiing, social events etc. What comes out it that the area is rather suitable for those activities except the two industrial landscapes : the quarry and the exploited wetland. The high suitability is due to of the snow cover in winter.

Thus, the banks of the river are also rather suitable.

LOW

HIGH

MEDIUM

1



Example of winter/land activity : husky sledge in the forest

6

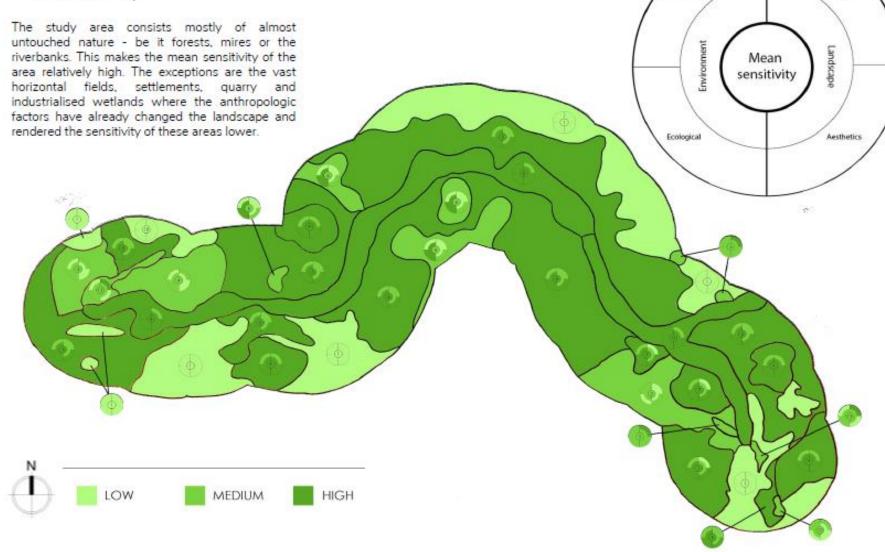
Vast horizontal fields
 Rolling cultivated landscape
 Manor landscape
 Mosaic Landscape
 Pine pillar forest
 Flat mixed forest
 Rolling mixed forest
 Meandering river banks
 Mire landscape
 Industrialized wetland
 Meandering sandy banks
 Quarry
 Settlements

Assessing sensitivity: supply side

- Consider the different aspects which may be affected by specific forms of recreation
- Ecological sensitivity eg. disturbance of wildlife, trampling of vegetation
- Soils/hydrology eg. erosion of soil, water pollution
- Aesthetic/sensory eg. views, noise, crowding, facilities
- Cultural historical eg. historical features, damage risk
- Consider weighting of more important aspects

	ENVIRONMENT			LANDSCAPE										
LCA-UNIT	ecological		geophysical		cultural	aesthetic			AVERAGE SENSITIVITY	FINAL RESULT				
	vegetation	widire	average	water pollution	erosion	average	historical	visual	noise	crowding	facilities	average		
1. Vast horizontal fields	2	2	2	2	1.5	1.75	1	1.5	2	1	1	1.375	1.53125	LOW
2. Rolling cultivated landscape	2	4	3	2	3	2.5	1	3	2	1	2	2	2.125	MEDIUM
3. Manor landscape	4	4	4	2	1.5	1.75	3	3	4	i	2	2.5	2.8125	MEDIUM
4. Mosaic Landscape	4	4	4	2	1.5	1.75	2	1.5	2	1	1	1.375	2.28125	MEDIUM
5. Pine pillar forest	6	6	6	2	3	2.5	2	3	6	2	3	3.5	3.5	HIGH
6. Flat mixed forest	w	6	6	2	1.5	1.75	1	15	6	2	2	2.875	2.90625	MEDIUM
7. Rolling mixed forest	w	6	6	2	3	2.5	1	3	6	2	2	3.25	3.1875	HIGH
8. Meandering river banks	w	6	6	3	4.5	3.75	2	4.5	6	3	3	4.125	3.96875	HIGH
9. Mire landscape	w	6	6	3	1.5	2.25	2	4.5	6	3	3	4.125	3.59375	HIGH
10. Industrialized wetland	2	2	2	2	1.5	1.75	2	15	2	1	1	1.375	1.78125	LOW
11. Meandering sandy banks	w	6	6	3	4.5	3.75	2	4.5	6	3	3	4.125	3.96875	HIGH
12. Quarry	2	2	2	1	4.5	2.75	2	1.5	2	1	1	1.375	2.03125	MEDIUM
13. Settelments	4	4	4	2	1.5	1.75	3	1.5	4	1	1	1.875	2.65625	MEDIUM

Sensitivity



Geophysical

Cultural

Assessing capacity

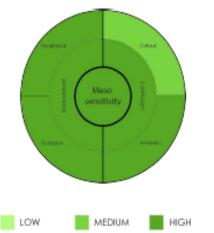
- Take the sensitivity and pressure/suitability for each LCA unit and calculate the capacity in relation to each recreation type according to the classification
- List the suitable activities in relation to the capacity and write a few guiding sentences for each – maybe provide a table with clear graphics and symbols

	WINTER/LAND	SUITABILITY	SENSITIVITY	CAPACITY
Capacity uninter/land man	1. Vast horizontal fields	MEDIUM	LOW	HIGH
Capacity : winter/land map	2. Rolling cultivated landscape	HIGH	MEDIUM	MEDIUM HIGH
	3. Manor landscape	HIGH	MEDIUM	MEDIUM HIGH
This map shows the capacity of the differents units for winter/land activities.	4. Mosaic Landscape	HIGH	MEDIUM	MEDIUM HIGH
Horizontal fields and settlements have the highest	5. Pine pillar forest	HIGH	HIGH	MEDIUM
capacity for this activities. The capacity of the water landscapes is low	6. Flat mixed forest	HIGH	MEDIUM	MEDIUM HIGH
because of rather low suitability and above all high	7. Rolling mixed forest	HIGH	HIGH	MEDIUM
sensitivity.	8. Meandering river banks	MEDIUM	нібн	MEDIUM LOW
	9. Mire landscape	MEDIUM	HIGH	MEDIUM LOW
	10. Industrialized wetland	LOW	LOW	MEDIUM
	11. Meandering sandy banks	MEDIUM	HIGH	MEDIUM LOW
	12. Querry	LOW	MEDIUM	MEDIUM
	13. Settlements	HIGH	MEDIUM	HIGH
	liGH			

8. Meandering river banks



SEASONAL ACTIVITIES	SENSITIVITY	SUITABILITY	IMPACT	NOTES	CAPACITY		
			LOW	swimming, canoeing, paddle boarding	MEDIUM HIGH		
SUMMER WATER	HIGH	HIGH	MEDIUM	sauna, spa			
			HIGH	motorboating	1		
			LOW	foraging, yoga/mediation, hiking			
SUMMER LAND	HIGH	MEDIUM	MEDIUM	cabin camping, social event	MEDIUM LOW		
			HIGH	Hunting			
			LOW	ice skating, ice fishing, kicksledding			
WINTER WATER	HIGH	HIGH	MEDIUM		HIGH		
			HIGH	snowmobile, ice drifting	1		
					LOW	snowman building, sauna, lightshow	
WINTER LAND	HIGH	MEDIUM	MEDIUM	cabin camping, social event, children's play	MEDIUM LOW		
			HIGH	hunting, snowmobile	1		



This LCA-unit includes the river which means that the water based activities is in focus. The Meandering river banks have a high sensitivity which is limiting for what activities is appropriate. The most suitable activities would be the ones with a low impact.

In the activity group summer/water the capacity is medium high and the activities appropriate would be; canoeing, swimming, fishing, sandcastle building, aquagym, pedal boating, paddle boarding and floating sauna. Because the sensitivity is high the activities with a higher impact, such as motorboating and spa, should be considered less suitable.

The water based activities in winter is rated high in this unit because the frozen ground is allowing more activities such as; ice skating, ice fishing, ice bathing, kick sledge, sauna. The less suitable activities would be; snowmobile and ice drifting because they are more noisy, although they could be allowed in certain places.

Some land activities appropriate for the river banks could be; foraging, tree climbing, yoga, meditation, hiking, nature trekking. The capacity is medium low so none of the motor based activities would be suitable for this area due to the sensitivity.

The winter land activities is rated high capacity and the suitable activities would be; snowman building, skiing, sledding, husky sledding, sauna, nature trekking and hiking.

Site-level assessment: application as part of a Landscape and Visual Impact Assessment

- A landscape and visual impact assessment (LVIA) is a component part of an Environmental Impact Assessment
- The work is split into two parallel complementary parts the landscape impact assessment and the visual impact assessment
- Impact is measured in terms of significance, in part calculated from a combination of sensitivity and magnitude of impact

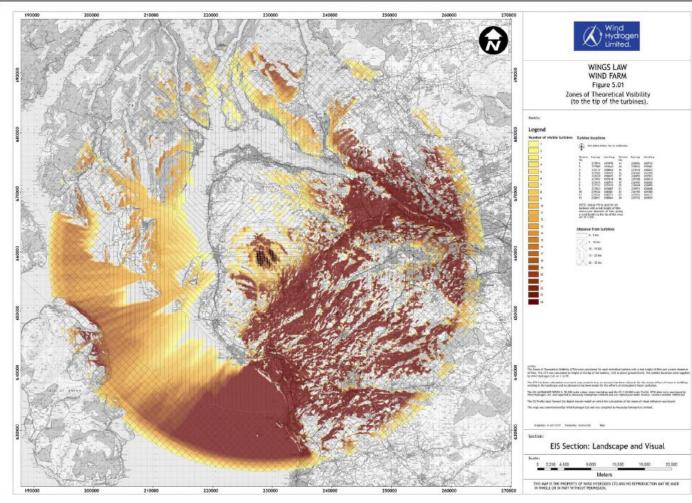
LVIA of a wind form development in southwest Scotland

- A development of 25 turbines proposed for a hill in southwest Scotland
- Seen from many settlements
- In a protected area (regional park)
- In a location where many other windfarms are already built or proposed

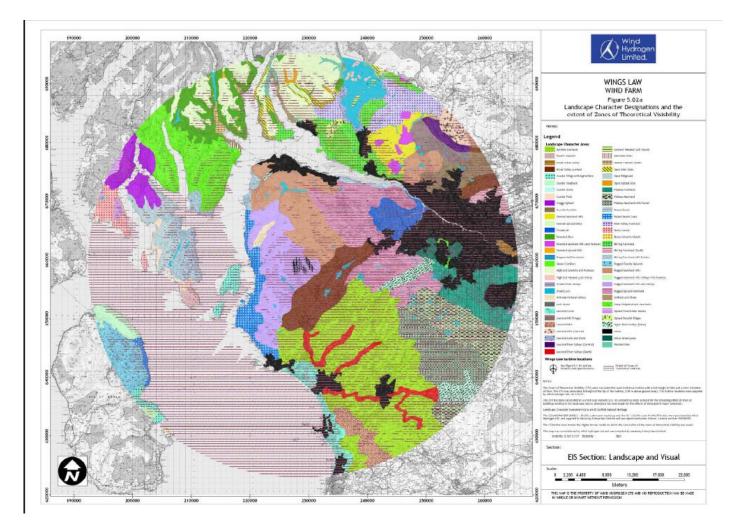
Location



Zone of Theoretical Visibility (ZTV) to 35km from the development



Overlay of Scottish LCA units on ZTV



Landscape and Visual Impact Assessment of Windfarm in Paldiski, Estonia



Prepared by

Janika Bachmann

Maria da Nazaré Rebelo

Landscape Resources

The Landscape Resources were divided into two categories: Landscape Character Units (LCU) and Landscapes of Interest (LI).

The Landscape Character Units where defined according to the Landscape Character Assessment methodology based on the following layers of the landscape:

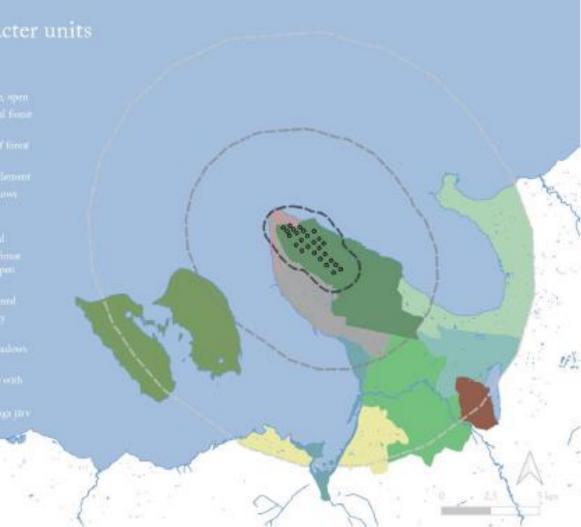
- Geology (exposed bed rock and sedimentary rock);
- Hydrology (Baitic sea, river mouth, meandering river, lake and drainage system);
- Land use (cliff, beach meadow, managed forest, natural forest, field);
- Settlements (no settlements, low-density settlements, seasonal settlements, urban settlements);
- Classified Heritage Sites.

This allowed the identification of ten LCU.

Landsacpe character units

legend

1 - March with a loss courtline, open 100 8 - Natural forest with some open-B - River mouth with open mandows - Wind Tirhine als 1km mdii Skar ndi



Sensitivity analysis

In this chapter, the main relevant baseline aspects for the sensitivity assessment of each landscape resource are presented, as well as their overall sensitivity. In appendix II it is possible to find the detailed assessment table.

Landscape character units

1 - Islands with a low coastline, open meadows and patches of natural forest and low-density settlements.

This landscape character unit corresponds to the two islands: Väike-Pakri and Suur-Pakri. These islands are important because they are a natura 2000 site and there are plans to make them an ecotourism destination. This landscape has a strong sense of place with big open and extensive meadows and patches of forest, but it also presents abandoned and destroyed buildings from the soviet times. It has no classified cultural heritage places. Most of this landscape character unit is within a 15km distance from the development site.

Overall sensitivity: Medium

2 - Open fields with patches of forest and low-density settlements

This type of landscape character unit can be found all over Estonia, especially when it comes to the land use pattern with the open extensive agriculture fields and patches of forest. This landscape character unit contains cultural heritage features of regional importance including the Harju-Madise church. Most of this landscape character unit is within a 15km distance from the development site.

Overall sensitivity: Low

3 - Klooga jarv with urban settlement surrounded by forest and Meadows

Klooga is now a city amongst the forest on the shores of Klooga järv but from 1943 to 1944 Klooga Concentration Camp was located there, during the Nazi occupation of Estonia. The landscape quite ordinary but the distinguishing feature is the lake and the history of the place, containing two classified memorial sites for the victims of the camp. This landscape character unit is within a 15km distance from the development site.

Overall sensitivity: Medium

4 - High coastline with Pakri Lighthouse

This landscape character unit is on a high costal limestone clift, characteristic of the northern Estonia coast, and contains Pakri lighthouse and other classified buildings. The lighthouse is a touristic attraction being well known in Estonia. The landscape character unit is also a Natura 2000 site. The entire landscape character unit is just next to the development site.

Overall sensitivity: High

















Sensitivity summary

Type	Name	Comment	Sensitivity
	 Islands with a low coastline, open meadows and patches of natural forest and low-density settlements 	The LCU is a Natura 2000 site and there are plans to make them a touristic destination while being far from the development site.	Medium
	2 - Open fields with patches of forest and low-density settlements	A very common type of LCU in Estonia but has a classified heritage site with regional and aesthetical value.	Low
	3 - Klooga järv with urban settlement surrounded by forest and Meadows	An urban area but with a strong history linked to the Klooga Concentration Camp including two classified memorial sites.	Medium
	4 - High coastline with Pakri Lighthouse	A well-known and characteristic northern Estonian coast landscape, neighboring the development site.	High
	5 - Low coastline with seasonal settlements and dense natural forest	Holiday and weekend houses in a natural Landscape with possible clear views of the development through the bay.	Medium
Landscape character unit	6 - Natural forest with some open meadows with no settlements	Natural forest with open meadow areas and a few houses with no classifies heritage site. Where the development will be located.	Medium
	7 – Meandering river with drained managed forest and low-density settlements	Although the river is a protected waterbody, this land use pattern can be found all over Estonia and it only has one heritage site (a sacrificial stone) that is also common.	Low
	8 - River mouth with open meadows and no settlements	Almost all the LCU is a Natura 2000 site, but due to de distance to the development site it is relatively unaffected by the development.	
	9 - Industrialised low coastline with an urban settlement	Although this is an urban and industrialized area, Paldiski is a known city in Estonia which has ten classified heritage sites.	Medium
	10 - Bog on the shores of Klooga järv	Bogs are valued landscapes in Estonia but due to the distance from the development site this LCU will not be uncharacterized by the development.	Low
	Pakri lighthouse and surroundings	This LI neighbors the development site and contains four classified heritage sites, including the famous Pakri lighthouse that provides a high viewpoint to the windfarm.	High
	Churches in Paldiski	LI of county importance near to the development site but in an urban setting.	Medium
	Amandus Adamson's house	LI of local importance close to development site but surrounded by buildings.	Low
	Memorials for the victims of the Koolga concentration camp	LI with national and historical importance but far away from development site.	Medium
	Harju-Madise church and church grounds	Church of county importance in an open landscape but far from development site.	Medium
Landscape of interest	Sacrificial stone	Classified Sacrificial stone connected with Estonian cultural heritage where people like to go to take photos but far from development site.	Medium
	Kõltsu manor park	Small manor and manor park with aesthetical value, close to the shore but with a swamp forest covering the possible view to the wind farm	Medium
	Nabessaar	The small classified peninsula is far form the development site but have a clear view of it from across the bay.	Medium
	Aidakivi	Classified Sacrificial stone connected with Estonian cultural heritage in natural setting, where people like to go to take photos, but far from development site.	
	Leetse manor	An attractive and regionally important LI neighboring the development site.	High

Magnitude of impact summary

Type	Name	Comment	Magnitude
	1 – Islands with a low coastline, open meadows and patches of natural forest and low-density settlements	The development area is elevated in comparison to the islands and islands' shoreline, in some cases, is characterized by open meadow.	Medium
	2 - Open fields with patches of forest and low-density settlements	The LCU is too far away from the development site and the topographical differences are not significant to make to windfarm visible.	Negligible
	3 - Klooga järv with urban settlement surrounded by forest and Meadows	The LCU is far away from the development site and Paldiski city is in the same direction so it is already a very grey landscape.	Negligible
	4 – High coastline with Pakri Lighthouse	Neighboring LCU to the development site where the turbines will be visible especially the two closest to it.	Large
Landscape character unit	5 - Low coastline with seasonal settlements and dense natural forest	The windfarm will only be visible from the shoreline because behind the beaches there is a natural forest covering the view.	Small
Landscape character unit	6 - Natural forest with some open meadows with no settlements	This is the LCA the site is located in. The enormous scale of the wind turbines will be evident and impossible to hide through screening objects such as trees.	Large
	7 – Meandering river with drained managed forest and low-density settlements	The LCU is too far away from the development site and the topographical differences are not significant to make to windfarm visible.	Negligible
	8 - River mouth with open meadows and no settlements	The windfarm will be quite far away and behind Paldiski so there is only a minor change in the landscape.	Small
	9 - Industrialised low coastline with an urban settlement	Although this is an urban and industrialized LCU, the proximity to the site and the fact that is on higher terrain, will make the windfarm visible.	Large
	10 - Bog on the shores of Klooga järv	The LCU is too far away from the development site and the topographical differences are not significant to make to windfarm visible.	Negligible
	Pakri lighthouse and surroundings	The tops of the wind turbines will be clearly visible from ground level and the entire windfarm will be visible form the top of the lighthouse.	Large
	Churches in Paldiski	The churches are already in an urban setting.	Small
	Amandus Adamson's house	The house is in the middle of a Paldiski neighborhood.	Small
	Memorials for the victims of the Koolga concentration camp	The LCU is too far away from the development site and the topographical differences are not significant to make to windfarm visible.	Negligible
	Harju-Madise church and church grounds	The LCU is too far away from the development site and the topographical differences are not significant to make to windfarm visible.	Negligible
Landscape of interest	Secrificial stone	The LCU is too far away from the development site and the topographical differences are not significant to make to windfarm visible.	Negligible
	Kõitsu manor park	The existing swamp forest screens out the development except in the area close to the beach where they will be visible on the horizon.	Small
	Nabessaar	The wind turbines are visible on the horizon across the bay,	Medium
	Aidakivi	The LCU is too far away from the development site and the topographical differences are not significant to make to windfarm visible.	Negligible
	Leetse manor	The tops of the turbines will be very visible due to the proximity.	Large

Significance of impact summary

Туре	Name	Comment	Sensitivity	Magnitude	Significance
	1 - Islands with a low coastline, open meadows and patches of natural	As the magnitude can be reduced with screening	Medium	Medium	Moderate
	forest and low-density settlements	objects on the shore, the significance is moderate.			
	2 – Open fields with patches of forest and low-density settlements	The distance from the development site was the	Low	Negligible	Negligible
		determining factor.			
	3 - Klooga järv with urban settlement surrounded by forest and Meadows	The distance from the development site was the	Medium	Negligible	Minor
		determining factor.			
	4 – High coastline with Pakri Lighthouse	The proximity to the site as well as the existence of	High	Large	Severe
		known classified heritage sites were the determining		, v	
		factors.			
	5 - Low coastline with seasonal settlements and dense natural forest	The existence of open view across the bay was the	Medium	Small	Moderate
Landscape character unit		determining factor.			
	6 - Natural forest with some open meadows with no settlements	The medium sensitivity was the determining factor,	Medium	Large	Major
		although the development will occur in this LCU.		Ŭ	· ·
	7 - Meandering river with drained managed forest and low-density	The communality of this type of LCU in Estonia and the	Low	Negligible	Negligible
	settlements	distance to the site were determining factors.			
	8 - River mouth with open meadows and no settlements	The fact that from this LCU development is seen	Low	Small	Minor
		behind Paldiski, was the determinative factor.			
	9 - Industrialised low coastline with an urban settlement	Although this is already and urban and industrialized	Medium	Large	Major
		area, the proximity was the determining factor.		Ŭ	•
	10 - Bog on the shores of Klooga järv	The distance from the development site was the	Low	Negligible	Negligible
	° °,	determining factor.			
	Pakri lighthouse and surroundings	The proximity to the site as well as the existence of a	High	Large	Severe
		high viewpoint were the determining factors.		, v	
	Churches in Paldiski	The fact that this U is in an urban area was the	Medium	Small	Minor
		determining factor.			
	Amandus Adamson's house	The fact that this LI is in an urban area was the	Low	Small	Minor
		determining factor.			
	Memorials for the victims of the Koolga concentration camp	The history of the place but mostly the distance were	Medium	Negligible	Minor
	° '	the determining factors.			
	Harju-Madise church and church grounds	The county importance, the aesthetical value but	Medium	Negligible	Minor
		mainly the distance of this U were the determining			
Landscape of interest		factors.			
	Sacrificial stone	The distance from the development site was the	Medium	Negligible	Minor
		determining factor.			
	Kõltsu manor park	The existence of trees that screen the view, was the	Medium	Small	Minor
		determining factor.			
	Nabessaar	The visibility of the development on the horizon, from	Medium	Medium	Moderate
		over the bay, was the determining factor.			
	Aidakivi	The distance from the development site was the	Medium	Negligible	Minor
		determining factor.			
	Leetse manor	The proximity to the site and the attractiveness of this	High	Large	Severe
		U were the determining factors.		- 0-	

Conclusions

- Landscape character assessments have a wide range of applications in landscape planning
- Using the concept of landscape sensitivity is an effective way of evaluating if proposed developments are likely to have negative consequences for the landscape character – especially if that character is strong and highly valued by people
- When landscape character assessments are carried out at different scalar levels, their application can also range from more regional-based strategic approaches down to the more detailed assessment of impacts.
- While visual impact is a separate topic in LVIA, visual quality is embedded in LCA and can be part of the sensitivity assessment for planning