



**Landgræðslan**

Síðan 1907

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Síðan 1907

# Landnotkun, gróðurhúsaloft- tegundir og loftslagsbókhaldið

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Jóhann Þórsson

Ársfundur SSNE, 9. apríl 2022

# Losun gróðurhúsa- lofttegunda

Viðskiptakerfi ESB  
með losunarheimildir  
(ETS)



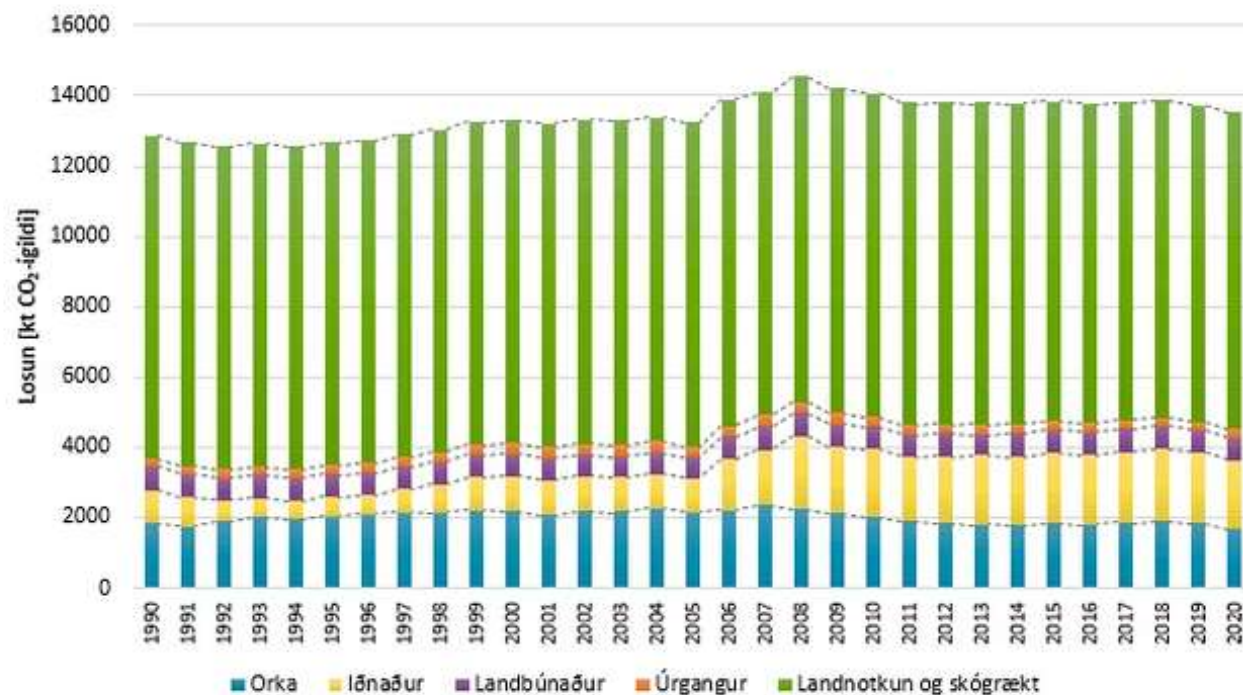
Bein ábyrgð Íslands



Landnotkun og  
skógrækt  
(LULUCF)



# 1990-2020 Heildarlosun með LULUCF



**Heildarlosun: 13.519 kt. CO<sub>2</sub>-íg.**

- 1990-2020: +5%
- 2019-2020: -2%

NIR 2022

- forest land
  - afforested land
  - deforested land
  - managed forest land
- managed grassland
- managed cropland
- settlement
- wetland
- (other land)

Land use category	Subcategories	Habitat type class	Habitat type/or other map layer	Compilation hierarchy
Forest land	Cultivated forest 1990-2017	Not HMI category	Not HMI category/	3
	Cultivated forest before 1990	Not HMI category	Not HMI category/	4
Forest land	Natural Birch forest	Not HMI category	Not HMI category/	5
Cropland	Cropland on organic soil	Not HMI category	Not HMI category/	12
	Cropland on mineral soil	Other land types	L14.2 Cultivated agricultural, horticultural and domestic habitats	13
Grassland	Revegetated land SCSi before 1990	Not HMI category	Not HMI category/	6
	Revegetated land SCSi 1990-2017	Not HMI category	Not HMI category/	7
	Farmers revegetation before 1990	Not HMI category	Not HMI category/	8
	Farmers revegetation 1990-2017	Not HMI category	Not HMI category/	9
	Natural Birch shrubland	Not HMI category	Not HMI category/	11
	Grassland on drained soils	Not HMI category	Not HMI category/	16
		Fell fields, moraines and sands	L1.6 Icelandic inland dunes	17
		Exposed aeolian soils	L2.1 Icelandic exposed andic soils	18
		River plains	L4.2 Icelandic braided river plains	19
		Moss lands	L5.3 Moss and lichen fjell fields	20
		Lava fields	L6.4 Icelandic lava field shrub heaths	21
		Coastal lands	L7.1 Icelandic sand beach perennial communities	22
			L7.4 Northern fixed grey dunes	23
			L7.7 Atlantic sea-cliff communities	24
		Grasslands	L9.1 Icelandic Carex bigelowii grasslands	25
			L9.2 Insular Nardus-Galium grasslands	26
			L9.3 Wavy hair-grass grasslands	27
			L9.4 Boreal tufted hairgrass meadows	28
			L9.5 Icelandic Festuca grasslands	29
			L9.6 Boreo-subalpine Agrostis grasslands	30
	L9.7 Northern boreal Festuca grasslands		31	
	Other Grassland	L10.1 Icelandic Racomitrium grass heaths	32	
		L10.2 Arctic Dryas heaths	33	
		L10.3 Icelandic Carex bigelowii heaths	34	
		L10.4 Icelandic Empetrum-Thymus grasslands	35	
		L10.5 Icelandic lichen Racomitrium heaths	36	
		L10.6 North Atlantic boreo-alpine heaths	37	
		L10.7 Oroboréal moss-dwarf willow snowbed communities	38	
		L10.8 North Atlantic Vaccinium-Empetrum-Racomitrium heaths	39	
		L10.9 Icelandic Salix lanata/S. phylicifolia scrub	40	
		L10.10 Oroboréal willow scrub	41	
	Woodlands	L11.1-3 subclasses of Birch wood	42	
	Other land types	L14.3 Mixed forestry plantations	43	

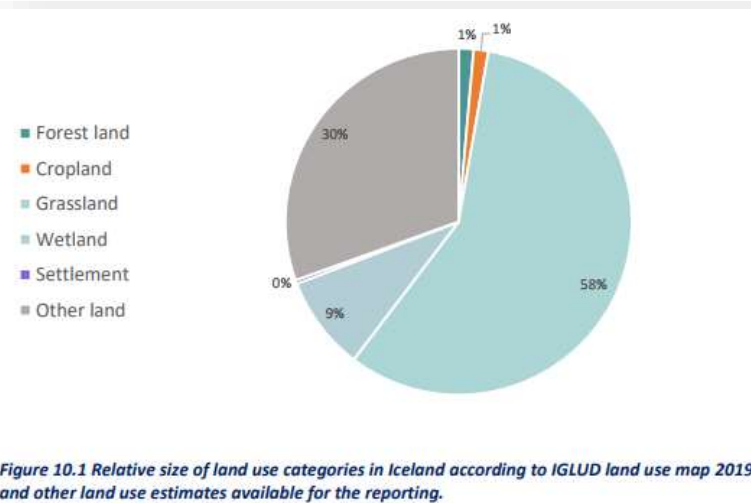


Figure 10.1 Relative size of land use categories in Iceland according to IGLUD land use map 2019 and other land use estimates available for the reporting.

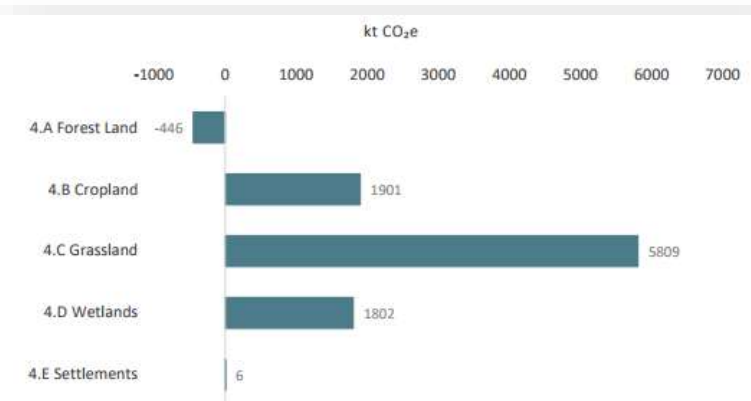
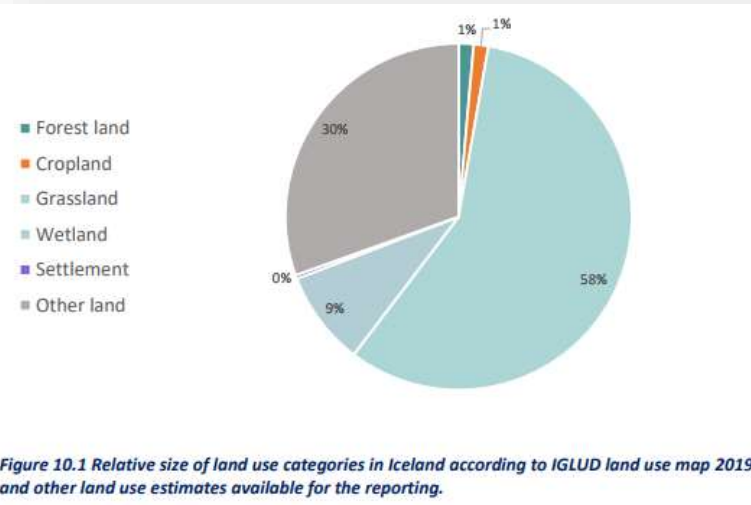


Figure 10.2 The net emissions/removals of land use categories (kt CO<sub>2</sub>e) in 2019. Emissions from Other land (4F) are not included in this graph. Since last year's submission, the N<sub>2</sub>O emission from Cropland management of organic soils is reported under the Agricultural sector and not included here.

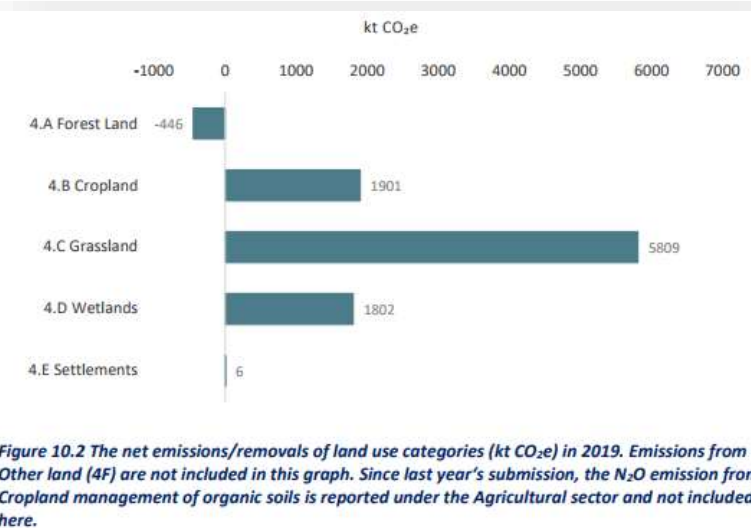
## Loftslagsbókhalds- skýrslur IPCC: NIR skýrslur

NIR 2021

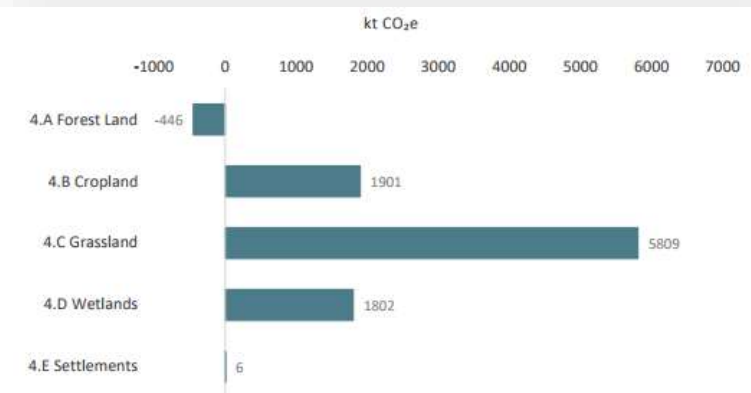
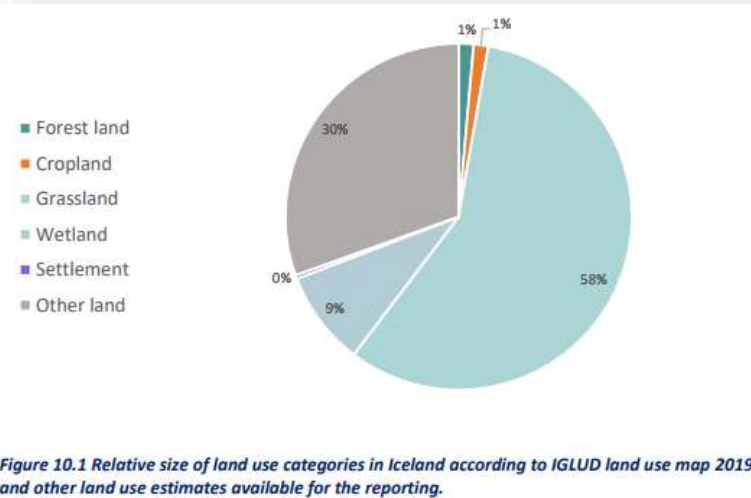


## Loftslagsbókhalds- skýrslur IPCC: NIR skýrslur

Mólendi – af  
hverju losar  
það svona  
mikið?



NIR 2021



Loftslagsbókhalds-  
skýrslur IPCC:  
NIR skýrslur

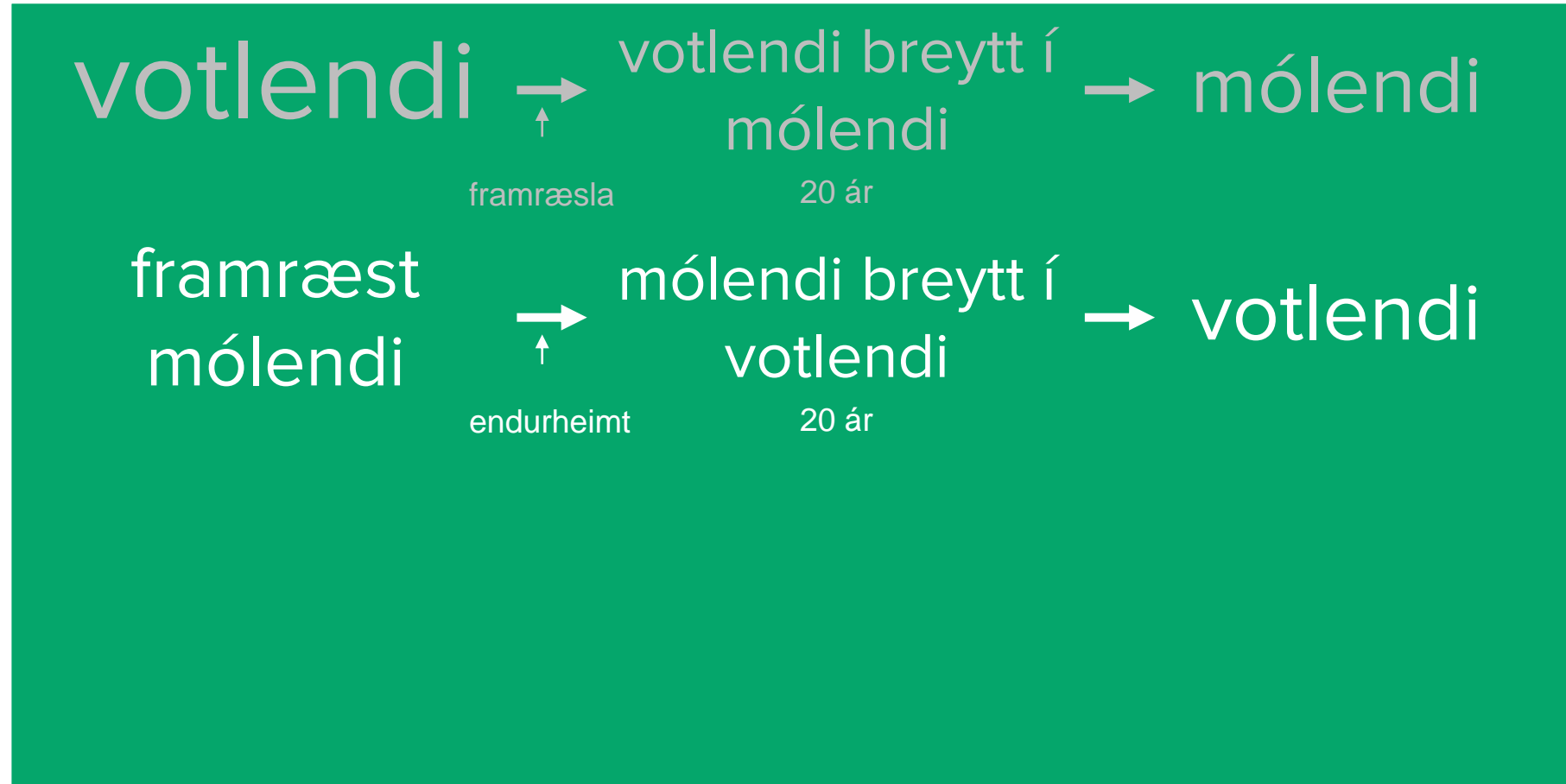
Mólendi – af  
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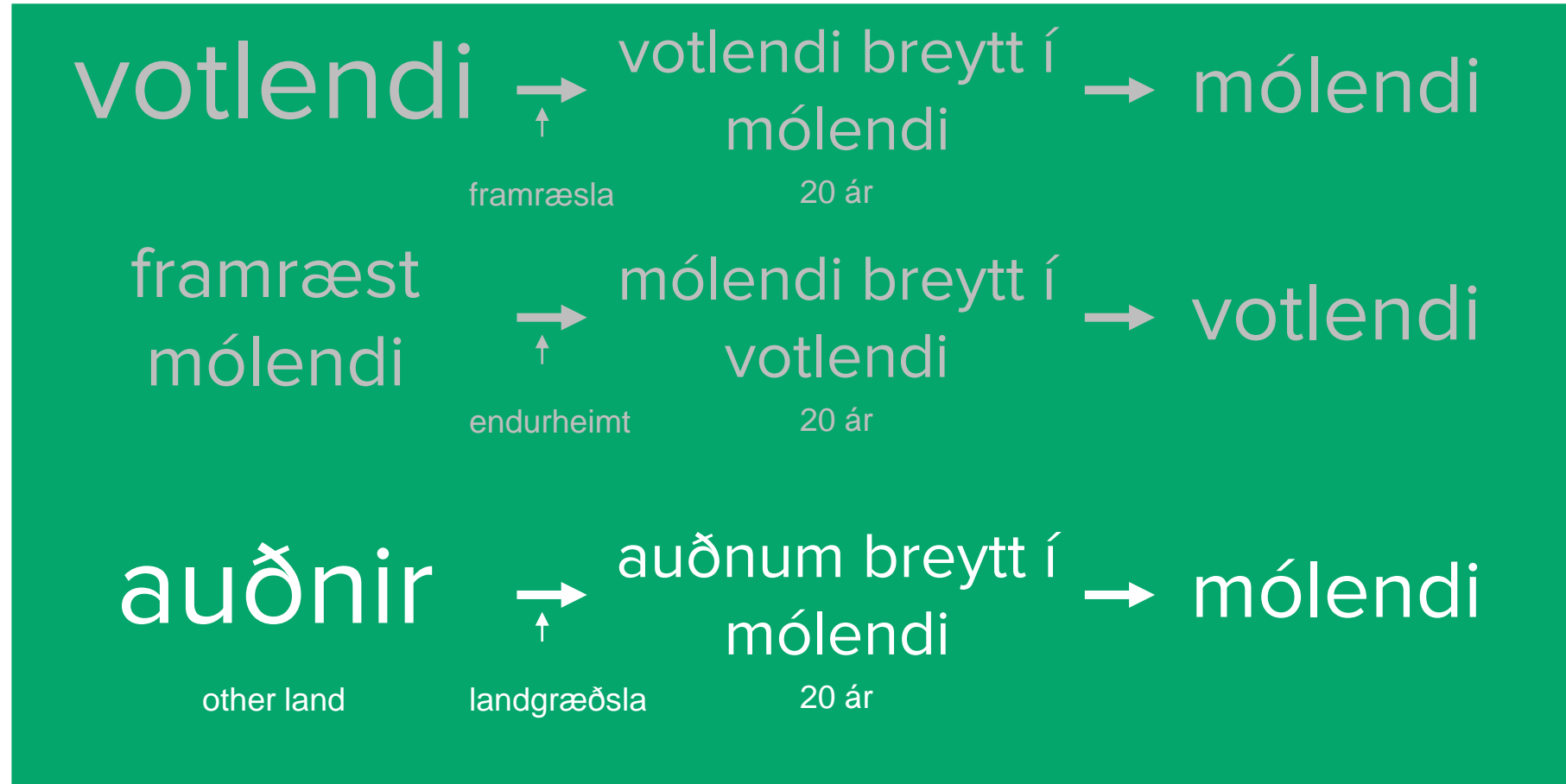
Framræst votlendi færir  
yfir í graslendisflokkinn

NIR 2021









# Framtalsskylda - Skuldbindingar



Aðgerða- og áætlunaskýrslur til ESB: PaMs

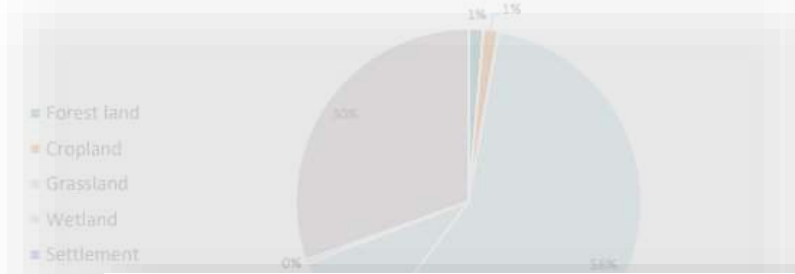


Figure 10.1 and other land use categories.

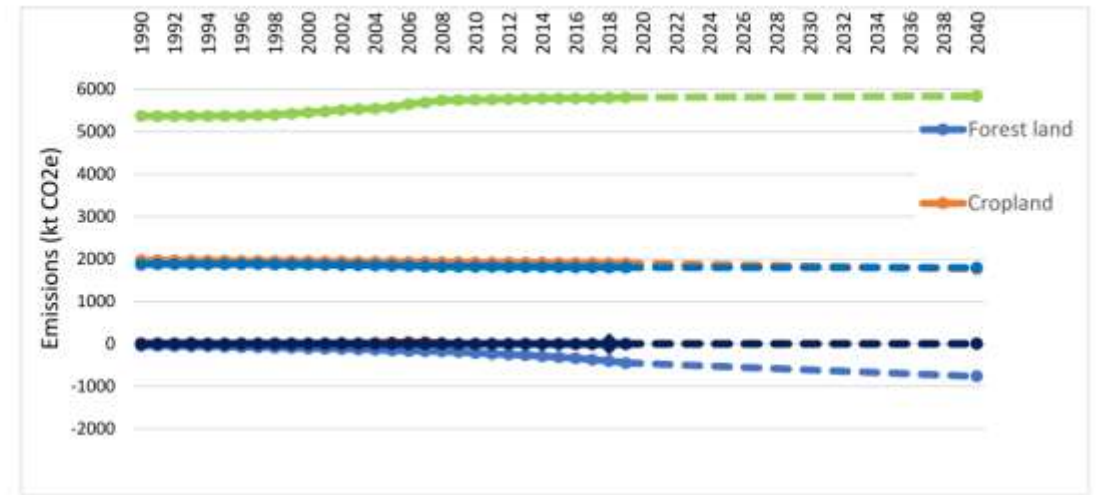


Figure 10.3 LULUCF Emissions Total GHGs (kt CO<sub>2</sub>e), WEM scenario

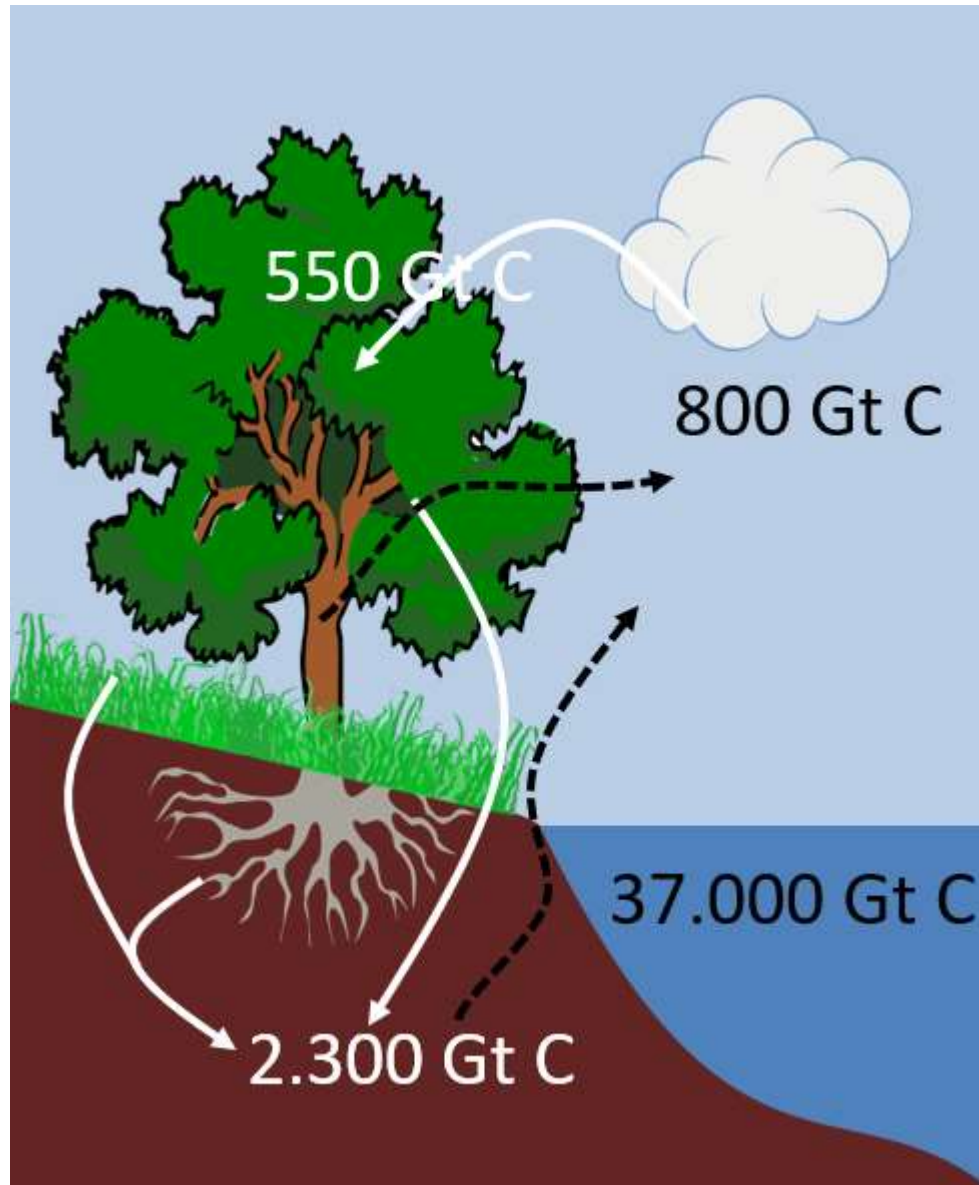
Table 10.1 Historical and projected emissions (kt CO<sub>2</sub>e) in the LULUCF sector

Categories	Emissions (kt CO <sub>2</sub> e)						
	1990	2019	2020	2025	2030	2035	2040
Forest land (4.A)	-43	-446	-452	-532	-606	-678	-765
Cropland (4.B)	1975	1901	1895	1864	1833	1802	1771
Grassland (4.C)	5372	5809	5812	5786	5755	5748	5837
Wetlands (4.D)	1872	1802	1801	1798	1798	1797	1795
Settlements (4.E)	16	6	6	6	6	6	6
Other Land (4.F)	0	0	0	0	0	0	0
<b>Total LULUCF</b>	<b>9192</b>	<b>9072</b>	<b>9062</b>	<b>8922</b>	<b>8786</b>	<b>8675</b>	<b>8645</b>

Figure 10.2 Other land use categories here.

Losun frá landi  
er óljós stærð,  
bæði á Íslandi  
og á heimsvísu



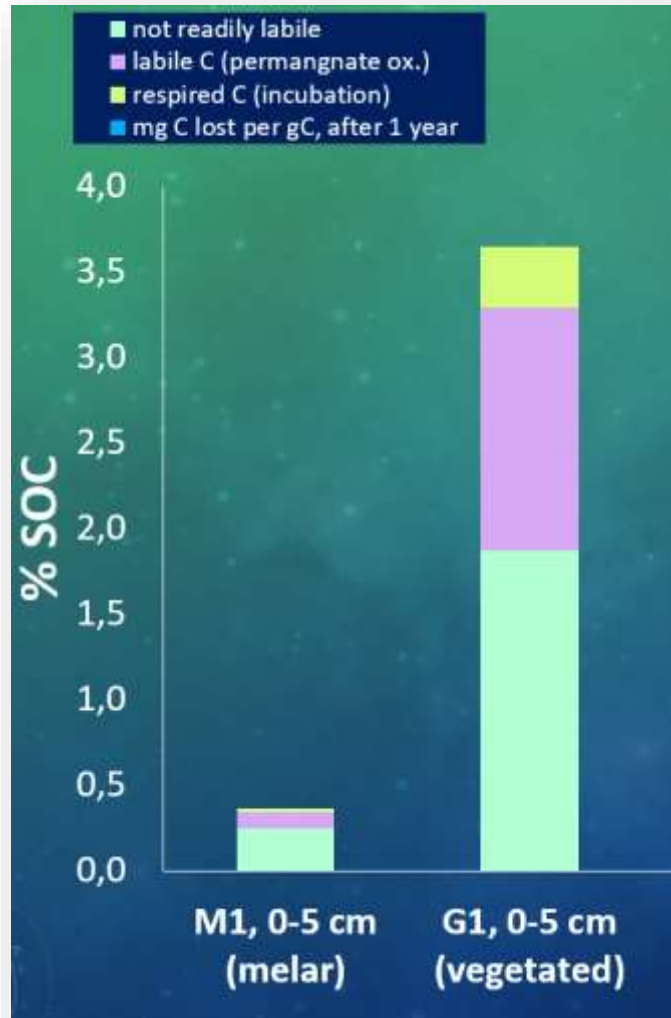


Stærsti hluti kolefnisforða þurrlendis er í jarðvegi.

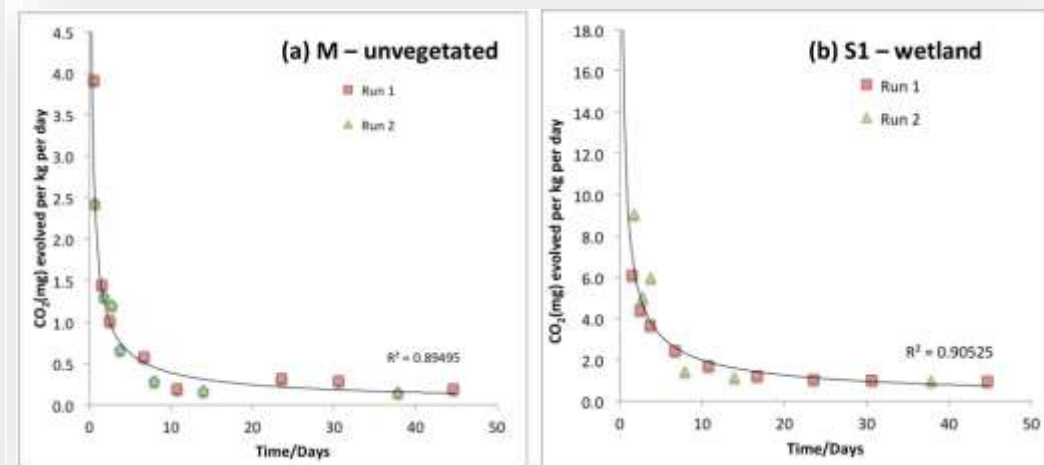
**Það er jafnframt stöðugasti kolefnisgeymirinn sem við höfum greiðan aðgang að**

## Stærsti hluti kolefnisforða þurrlendis er í jarðvegi

- Þar er jafnframt að finna stöðugasta kolefnið – við verðum að auka það



Mankasingh et al. óbirt gögn



Gísladóttir o.fl., 2014



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Soil

## UK is 30-40 years away from 'eradication of soil fertility'

Farmers must be incentivised to tackle decline in biodiversity, says environment secretary at launch of parliamentary soil body



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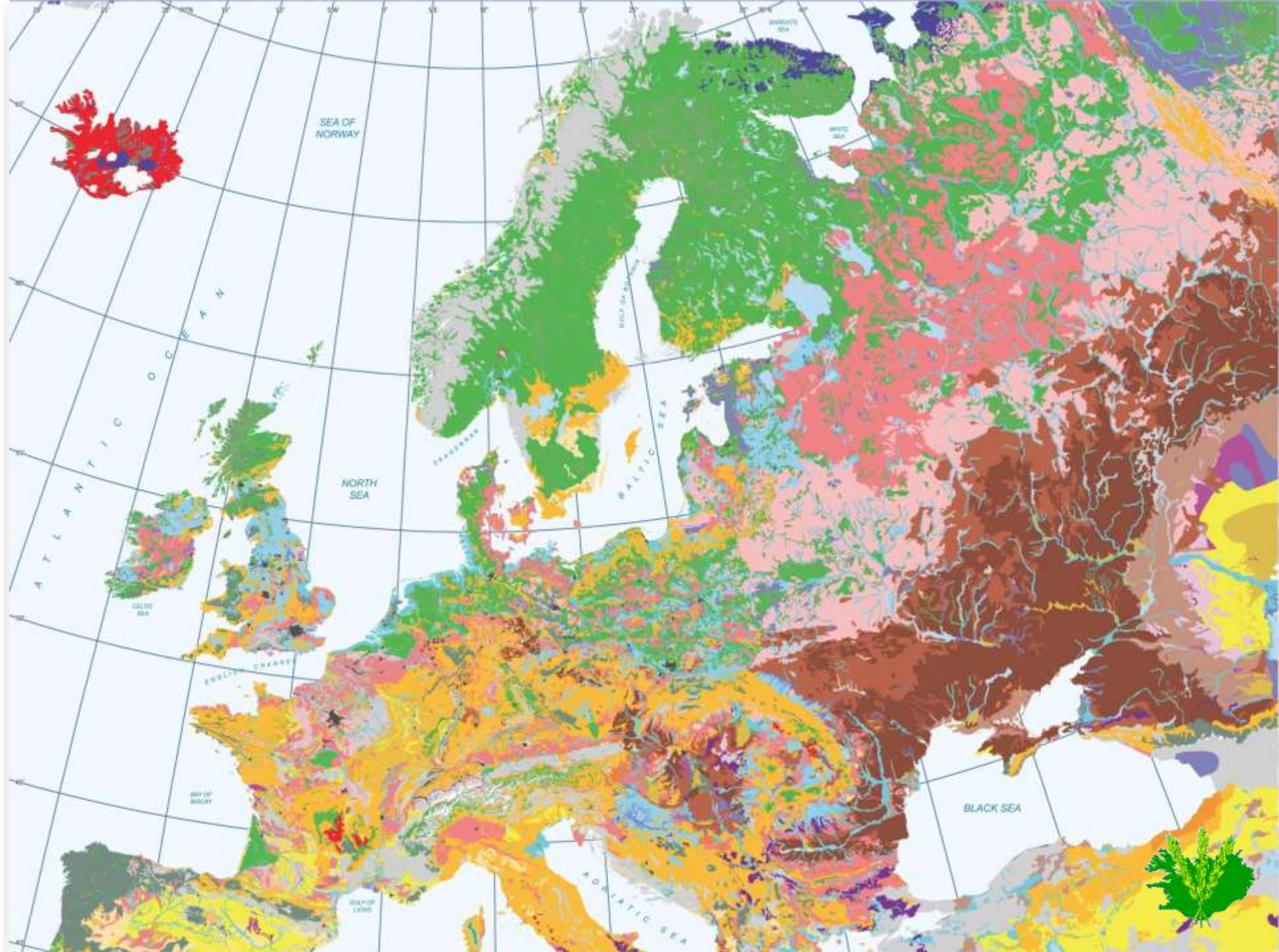
world UK science cities global development football tech business more

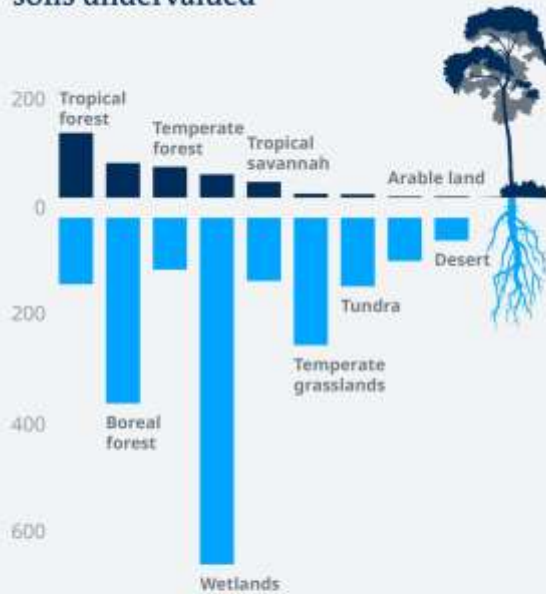
Soil

## Third of Earth's soil is acutely degraded due to agriculture

Fertile soil is being lost at rate of 24bn tonnes a year through intensive farming as demand for food increases, says UN-backed study





CO<sub>2</sub> storage: Flora overvalued,  
soils undervalued

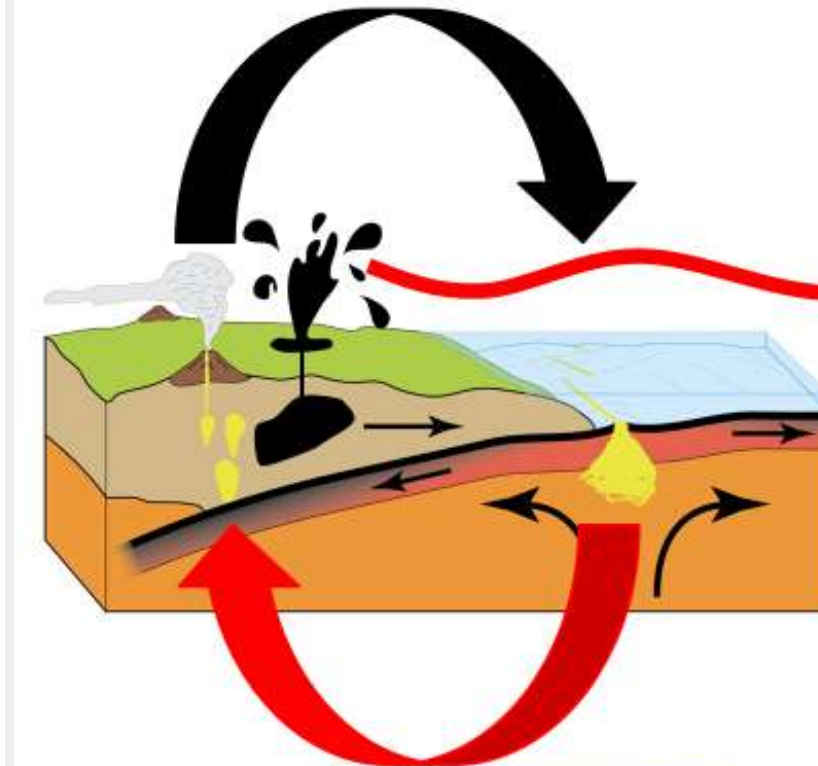
Average stored carbon in tons per hectare  
at a ground depth of one meter

Source: World Climate Council (IPCC)

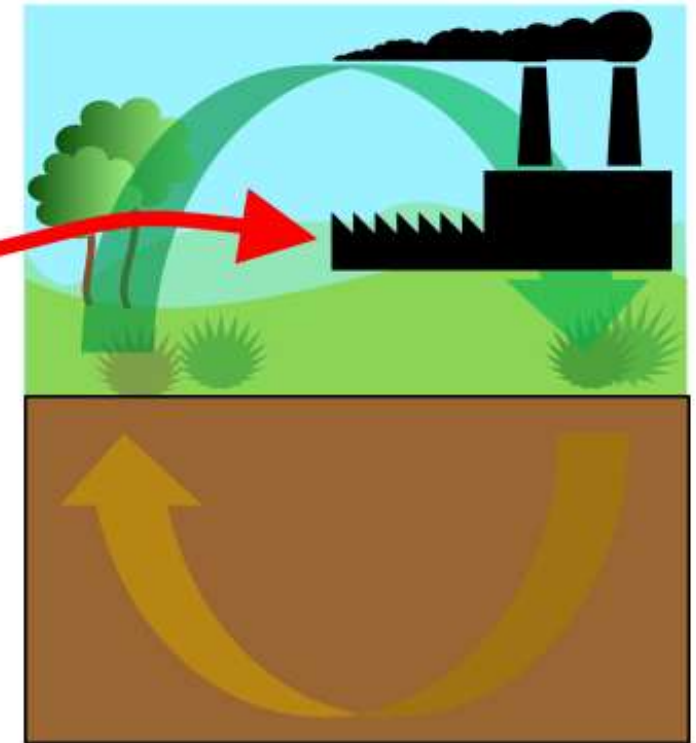
Kolefnisgeymir	Gt C
Andrúmsloftið	830
Gróður	450-650
Jarðvegur	1.500-2.400
Sífreri	1.700
Hafið (m/lífrænu seti)	40.450
Jarðefnaeldsneyti	1.000-1.940

IPCC 2013

## Hæga kolefnishringrásin



## Hraða kolefnishringrásin

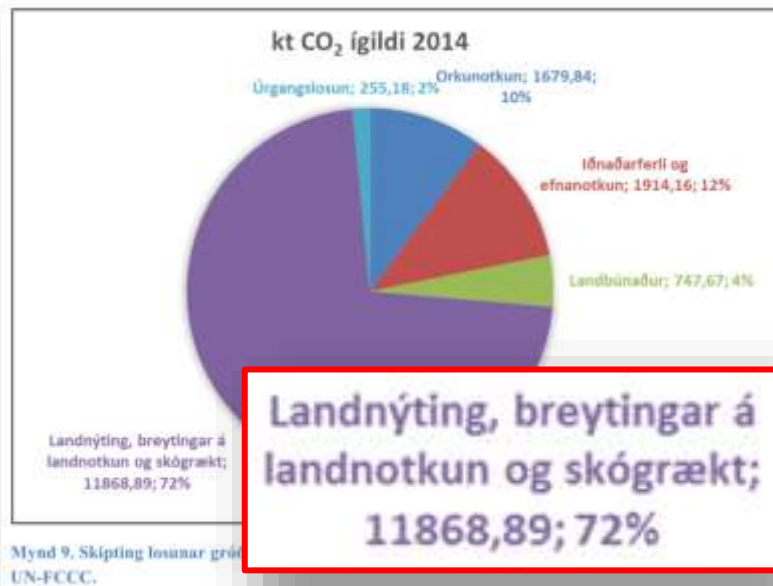


Jarðvegur er stöðugasti hluti kolefnishringrásarinnar sem við getum haft áhrif á og með því að binda kolefni þar erum við í raun að taka það út úr kolefnishringrásinni.



Tafla 25. Áætlun á kolefnistapi úr almennu mólendi miðað við að virkt rof sé í öllu rofnu landi. Flatarmál innan almenns mólendis áætlað út frá rofkortlagningu árána 1991-1996 (Arnalds et al. 1997).

	Flatarmál [kha]	Hlutfallsleg breyting á kolefnisforða*	Kolefnis forði 0-30 cm jarðvegs [t C ha <sup>-1</sup> ]**	Kolefnistap [kt C ári <sup>-1</sup> ]
<b>Rofflokkun</b>				
<b>Ekkert rof (0)</b>	446,3	1,00	90,5	0
<b>Lítið/minniháttar</b>	3.015,9	0,95	81,5	12.300
<b>Alvarlegt (3,4,5)</b>	1.192,8	0,70	26,0	9.300
<b>Samtals</b>	4.655,0			<b>21.600</b>



Jón Guðmundsson 2016:  
Greining og mæling á losun  
loftsláttargættis

80.000  
kt CO<sub>2</sub>  
eq!

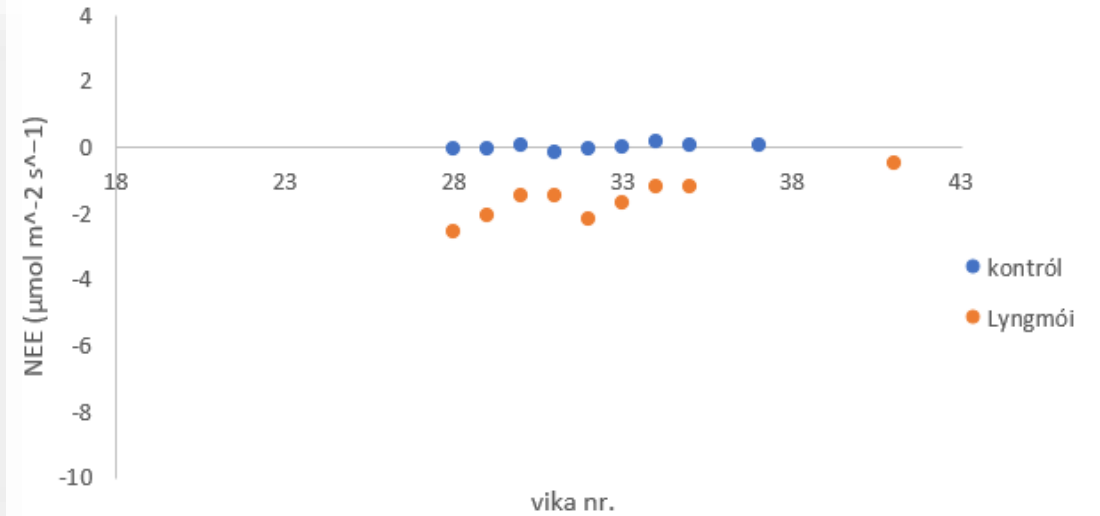
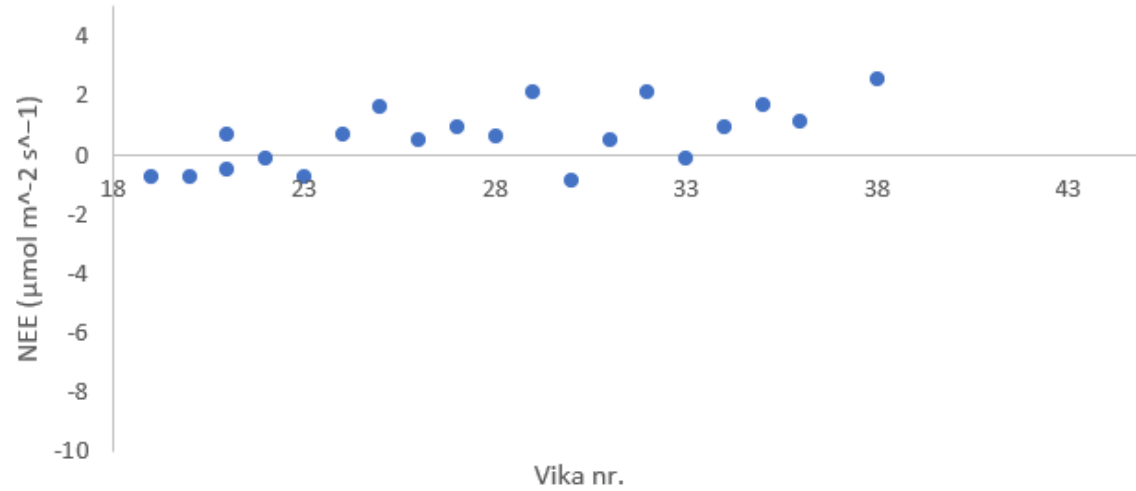
Losun vegna rofs gæti verið 8x öll losun vegna landnýtingar, breytingar á landnýtingu og skógrækt (LULUCF)

Landgræðsla er hugsanlega að binda fjórðung þessa á ári

**Tafla 37 Samantekt á losun og bindingu í landi utan býla eins og hún er sett fram í sviðsmyndum 1 og 2**

Losunarpáttur	Losun kt CO <sub>2</sub> ígildi á ári	Upptaka vegna	Upptaka kt CO <sub>2</sub> ígildi á ári
Almennt mólendi CO <sub>2</sub> Sv 1	40.000	Aukinn styrkur C í jarðvegi	2.100
Almennt mólendi CO <sub>2</sub> Sv 2	5.100	Landgræðsla	560
Framræst land utan býla	8.000	Binding vegna jarðvegsþykknunar	800
Almennt mólendi N <sub>2</sub> O	2.000	Vöxtur kjarrlendis	10
Almennt mólendi N <sub>2</sub> O	270	Binding í skógum	300
Votlendi	1.200		
<b>Samtals sviðsmynd 1</b>	<b>51.300</b>		<b>3.770</b>
<b>Samtals sviðsmynd 2</b>	<b>14.570</b>		<b>3.770</b>

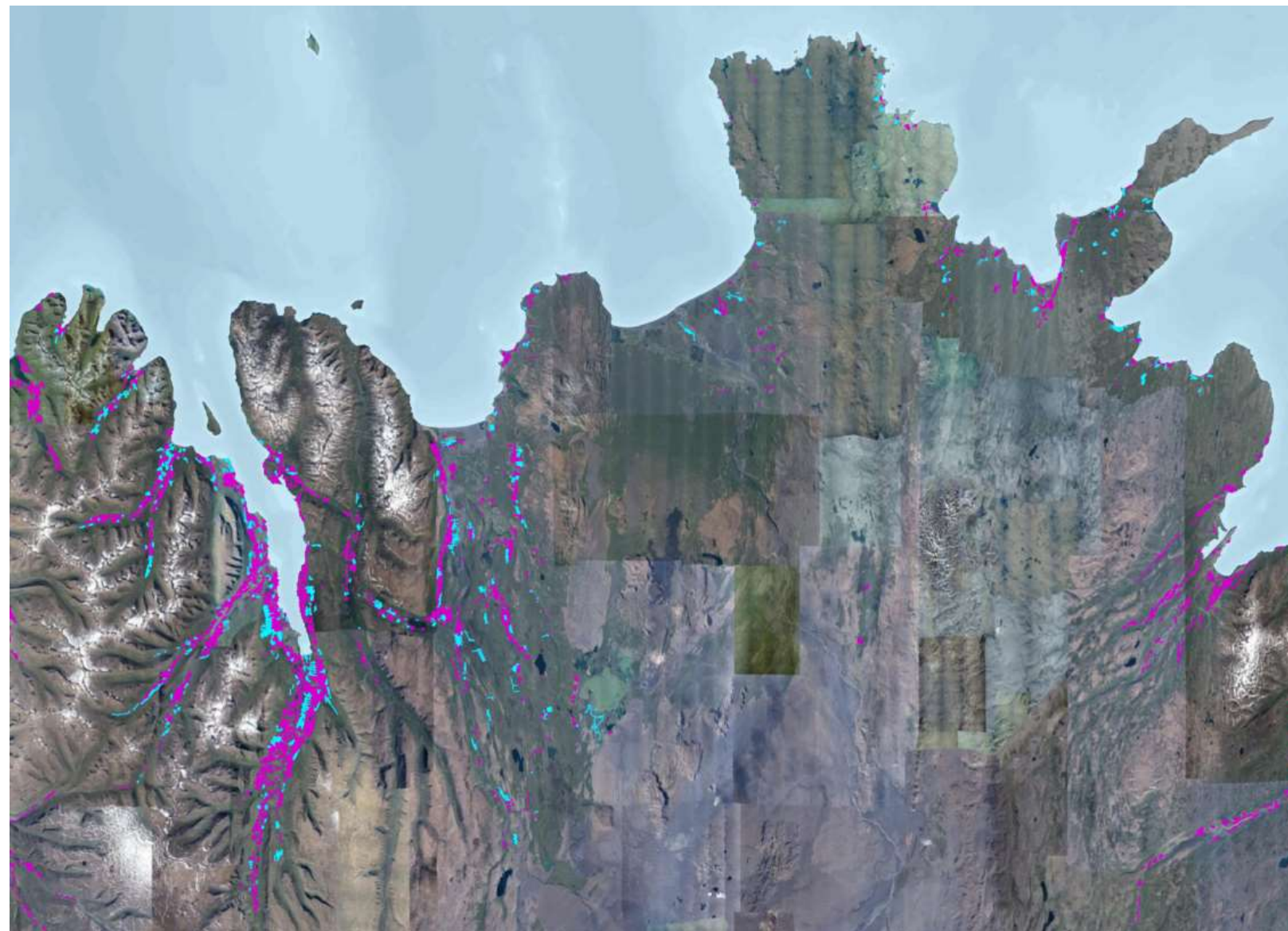
Samanburður á tvennskönar sviðsmyndum fyrir mólendi eingöngu. Sviðsmynd 1 gengur út frá IPCC stuðlum (tier 1) en sviðsmynd 2 er raunsærra mat höfundar.



Hvað er að gerast í þurrlendinu?



# Skurðir á NA-landi



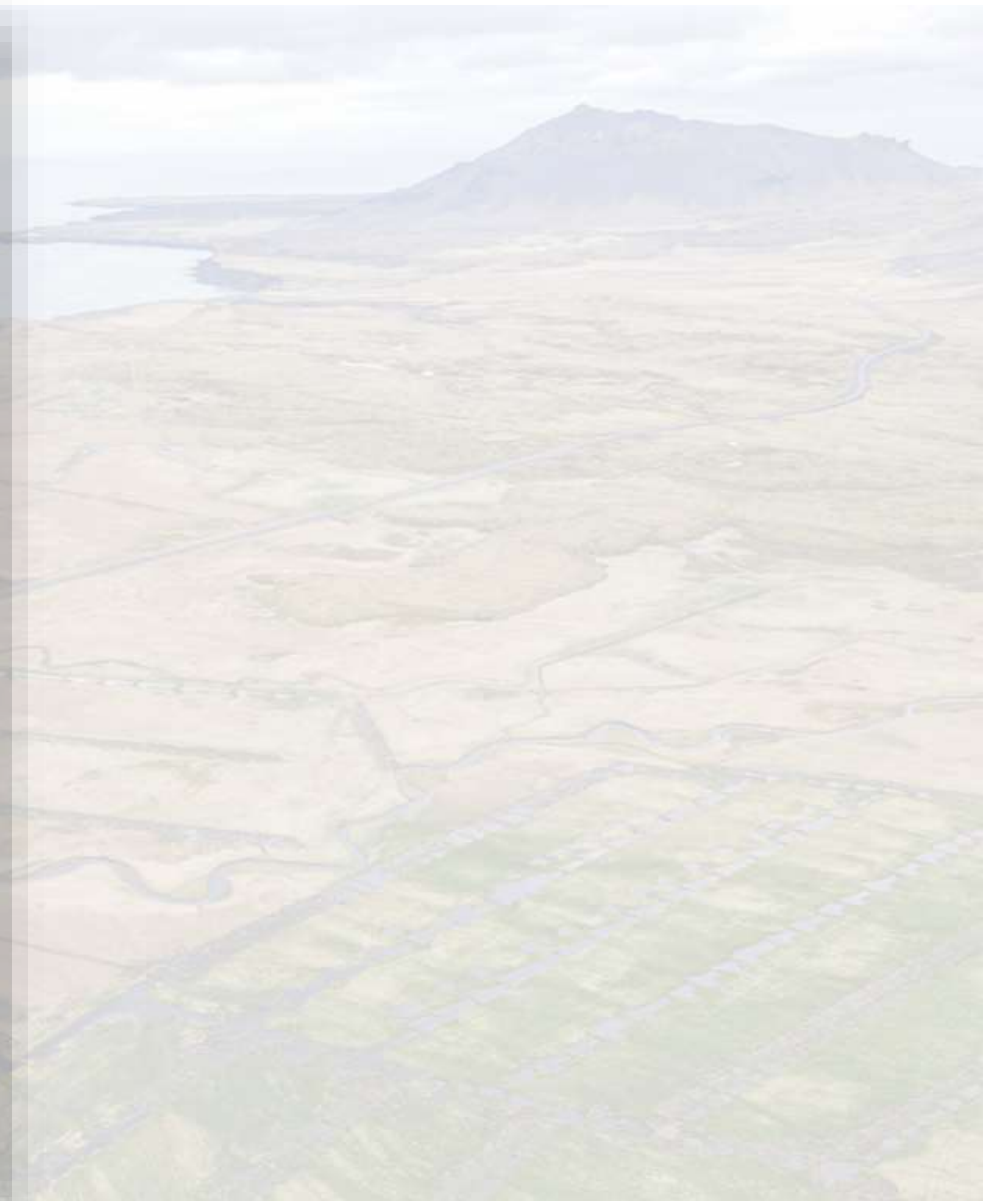
Iðunn Hauksdóttir



# Möguleg endurheimtarsvæði á NA-landi



Iðunn Hauksdóttir



Iðunn Hauksdóttir



Íðunn Hauksdóttir

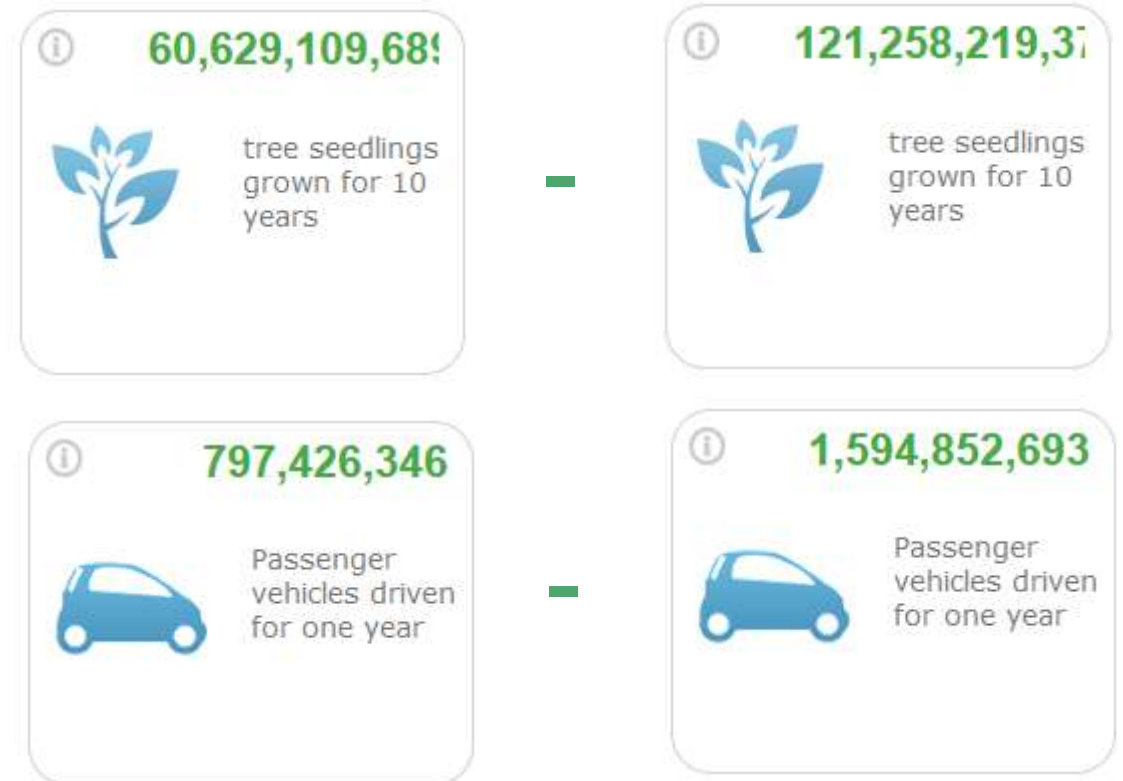
# Hver er staðan í dag?

Forsendur	C, t alls	Heimild
Vistgetukort	1.700.000.000	N.Í.
Eldra jarðvegskort	2.100.000.000	Hlynur Óskarsson o.fl. 2004
Jarðvegskort 2021	3.000.000.000	Ólafur Arnalds & Jón Guðmundsson 2020

$\Delta \approx -1.000.000.000$  til  $-2.000.000.000$  t C  
miðað við landnám

Hlynur Óskarsson o.fl. (2004) áætlaði að  
120.000.000 til 500.000.000 t C hefðu  
tapast frá rofjöðrum eingöngu

Landgræðsla: 5.000 – 100.000 ár  
Skógrækt: 4.000 – 8.000 ár



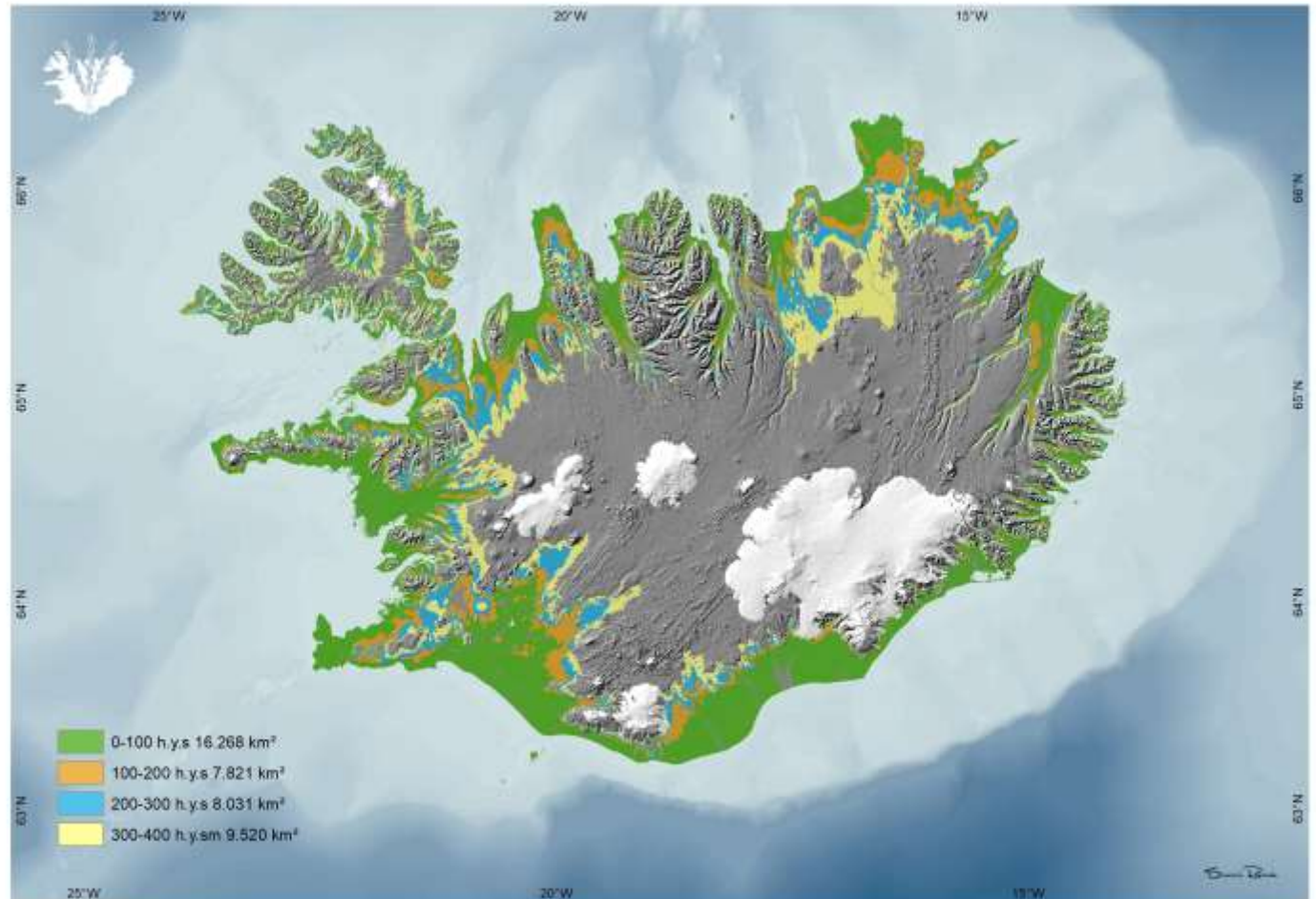
EPA.gov

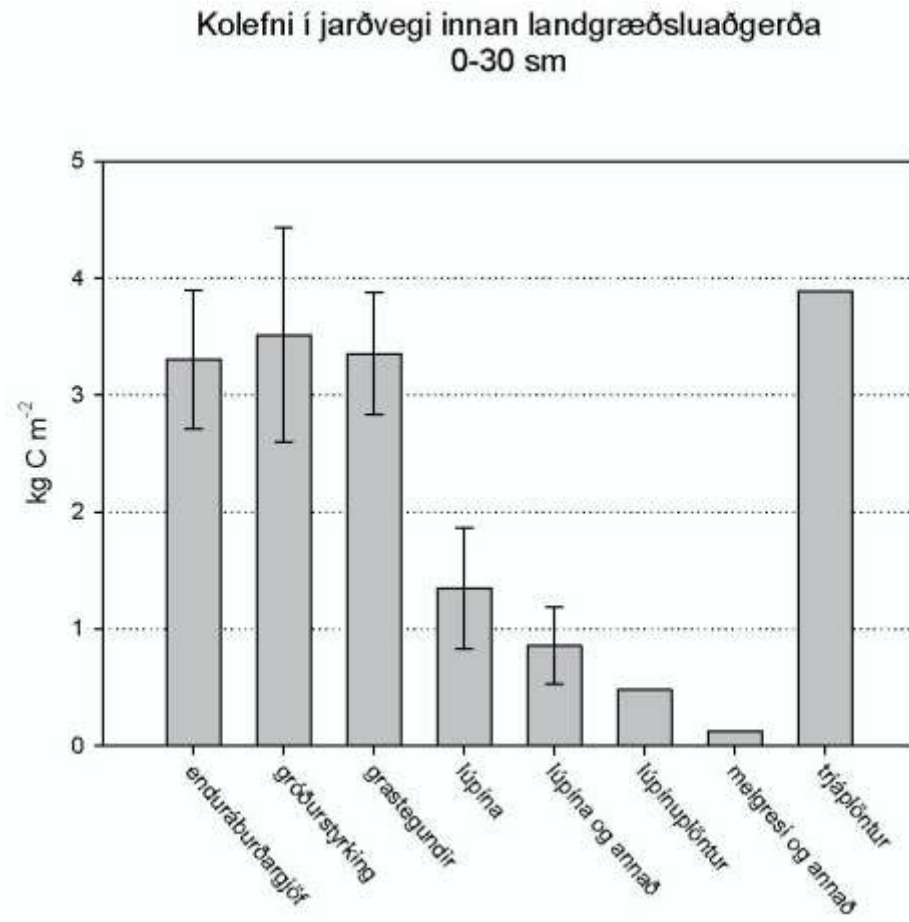
# Staðan við landnáám?

## Forsendur

- Landi skipt í hæðarbil sem hafa mismunandi jarðvegsþykkt (minnkandi með hæð)
- Kolefni í jarðvegi er hæst í 30% efstu jarðlögunum, annars vegar 18% og hins vegar 12%
- Rúmpyngd er 0,65

hæð yfir sjó	jarðvegsþykkt	C, kg m <sup>-2</sup>	C, t hæðarbil
0-100m	1,5m	135	2.200.000.000
100-200m	1,0m	90	700.000.000
200-300m	0,7m	67	540.000.000
300-400m	0,5m	45	430.000.000
Samtals			3.870.000.000





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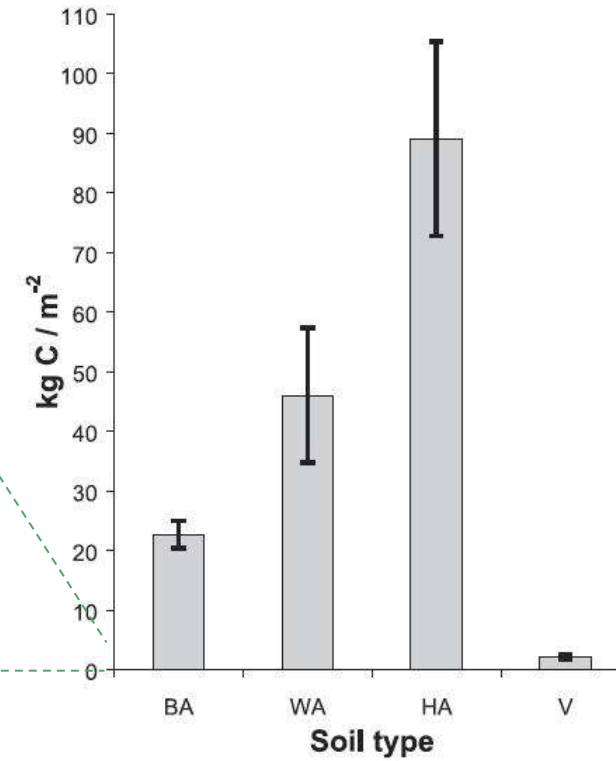
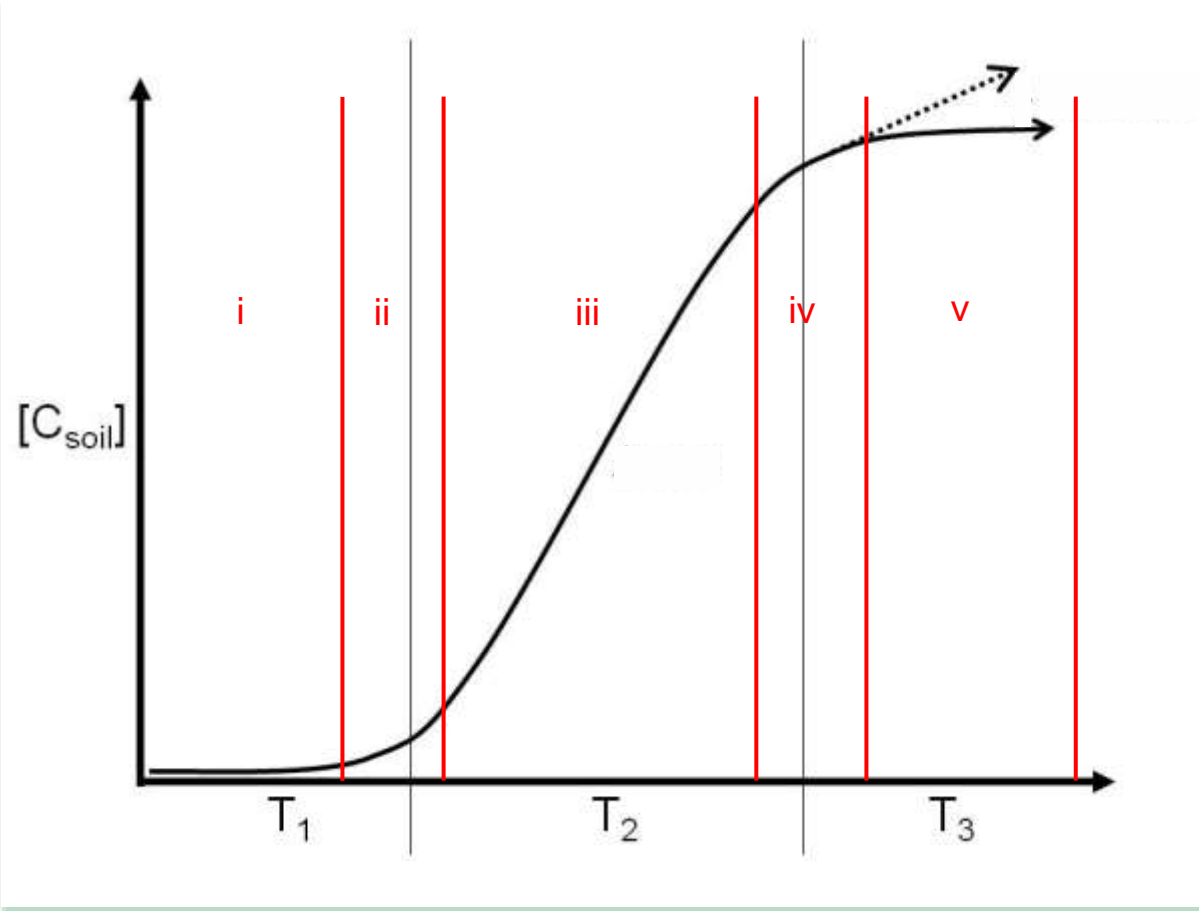
*H. Óskarsson et al. / Catena 56 (2004) 225–238*

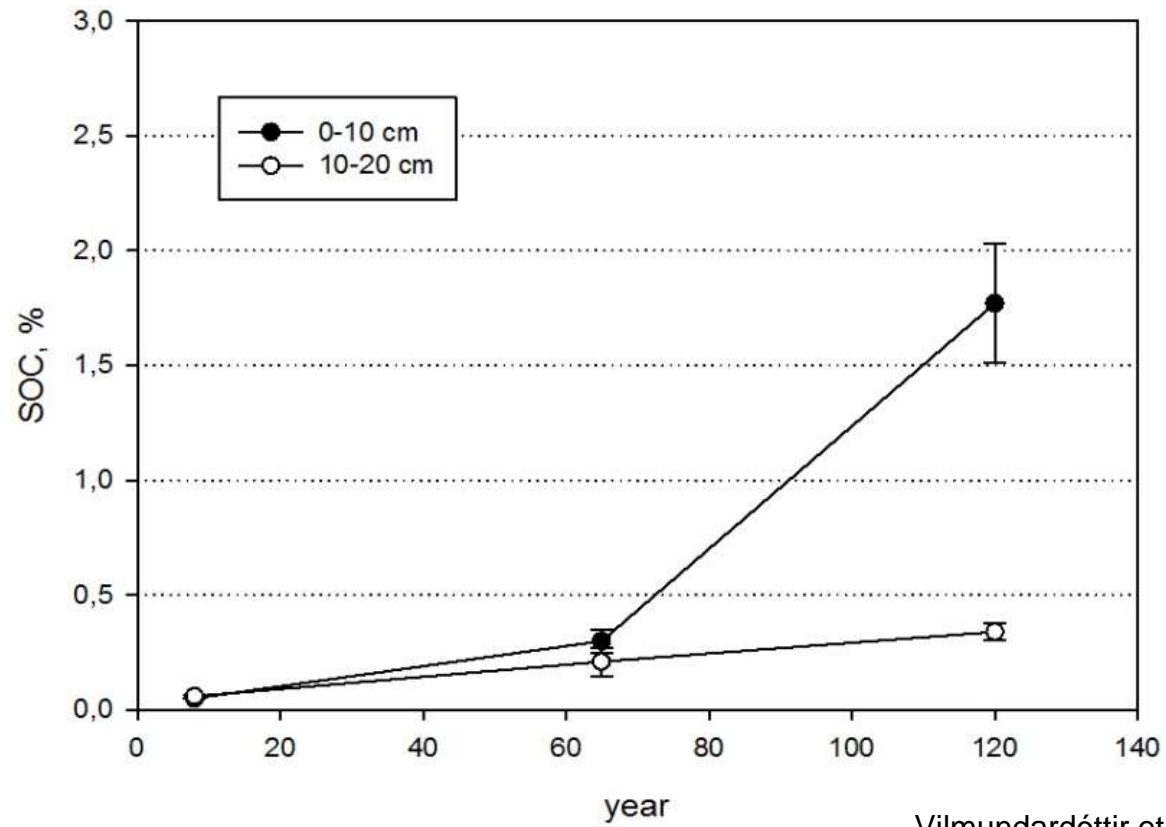
Fig. 1. Organic carbon stocks of the four main soil types in Iceland. BA=Brown Andosol; WA=Gleyic Andosol; HA=Histic Andosol; V=Vitrisol; see Arnalds (2004) for further description of soil types. Bars represent  $\pm 1$  standard error.



fasi	binding, $\text{ha}^{-1} \text{ár}^{-1}$	hlutfall	lengd
i	0,1 t $\text{CO}_2$	5%	11 ár
ii	1,1 t $\text{CO}_2$	50%	5 ár
iii	2,1 t $\text{CO}_2$	100%	29 ár
iv	0,8 t $\text{CO}_2$	40%	6 ár
v	0,2 t $\text{CO}_2$	10%	9 ár

Miðað er við að mesti hraði kolefnis-bindingar náist eftir 16 ár og standi í 29 ár. Þá dragi úr hraða bindingarinnar en hún verði samt viðvarandi, vegna áfoks, til loka matstímabilsins sem hér er talið 60 ár.

### Early stage development of selected soil properties along the proglacial moraines of Skaftafellsjökull glacier, SE-Iceland



Vilmundardóttir et al. 2014