

# Natural Capital Accounting and the Afghanistan case study

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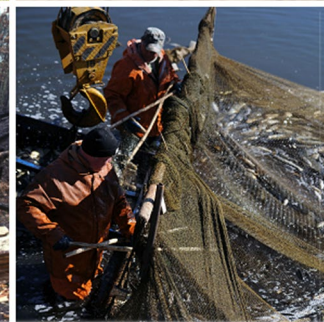
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# OUTLINE

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- Why natural capital is important
- The Natural Capital Accounting activities in Eastern Afghanistan: a FAO-GEF pilot assessment for Khost, Laghman and Nuristan provinces paper *background* and *rationale*
- Ecosystem *types* and *ecosystem extent accounts*



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# OUTLINE

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- *Ecosystem conditions*
  - Soil carbon
  - Land cover change
  - Productivity
- Derivation of indicator *15.3.1*
- *Ecosystem services – biodiversity*

Q/A

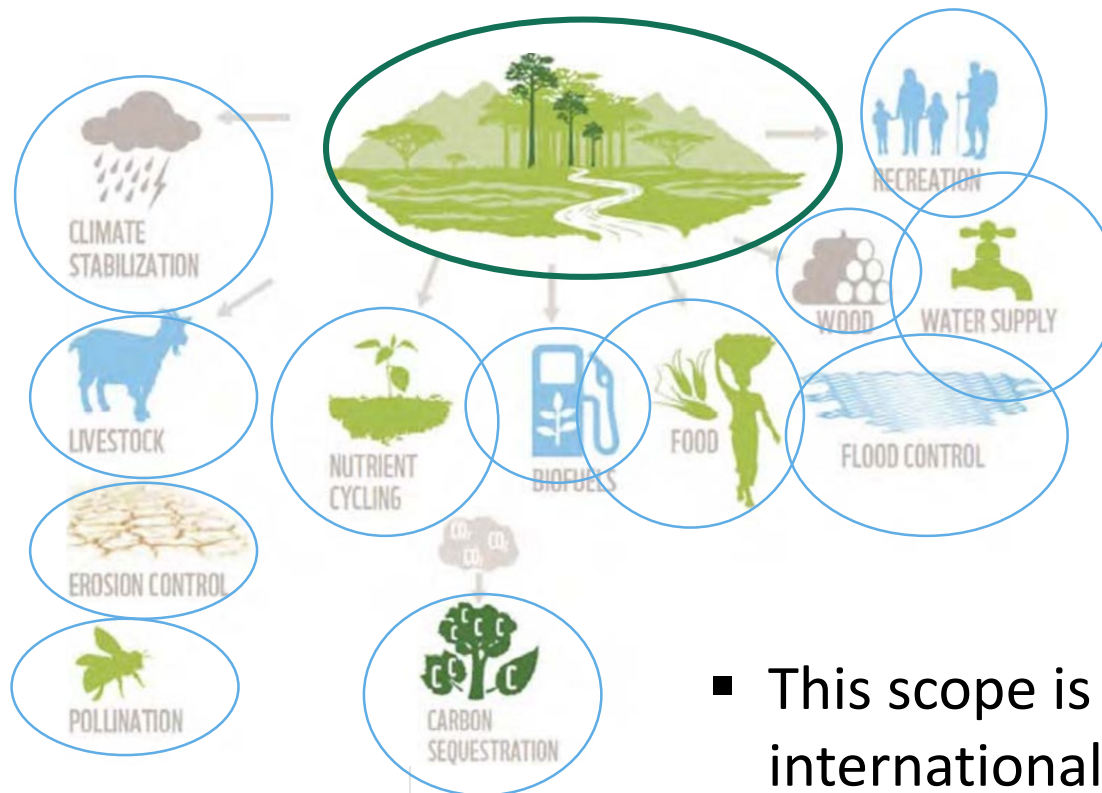


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# Why natural capital is important

- Natural capital accounting aims to value the world's stocks of natural assets, their biodiversity and their ecosystem services in both monetary and physical terms



- This scope is essential in today international and national agenda (SDGs, CBD, NBSAP etc)

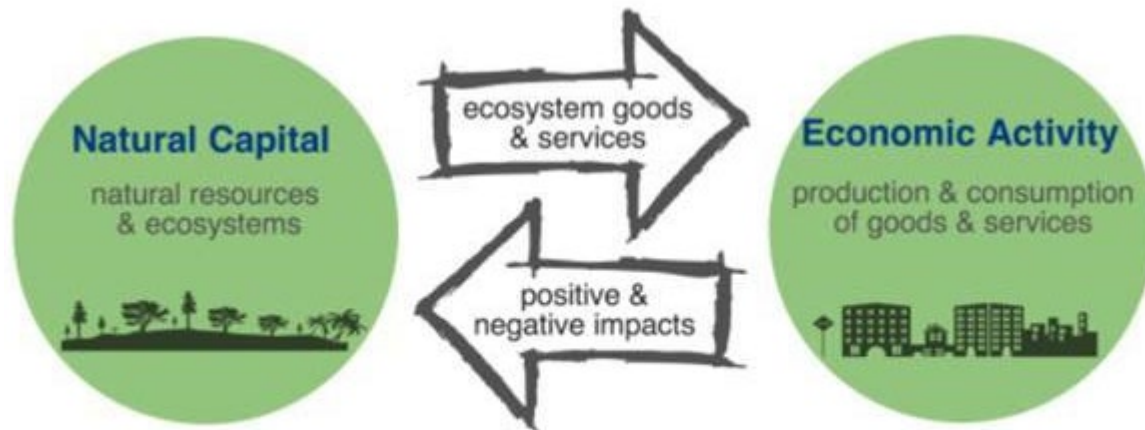


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# Why natural capital is important

- Natural capital is a methodology to link multiple environmental dimensions to main economic aggregate, as the GDP



... if we extract too much from nature or cause environmental damage, we degrade our natural capital and put our economy at risk

- It allows to analyse environmental and ecological issues in an economic perspective



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# Why natural capital is important

- It is a standardized language, which allows comparability over time and over countries of environmental-economic data and indicators



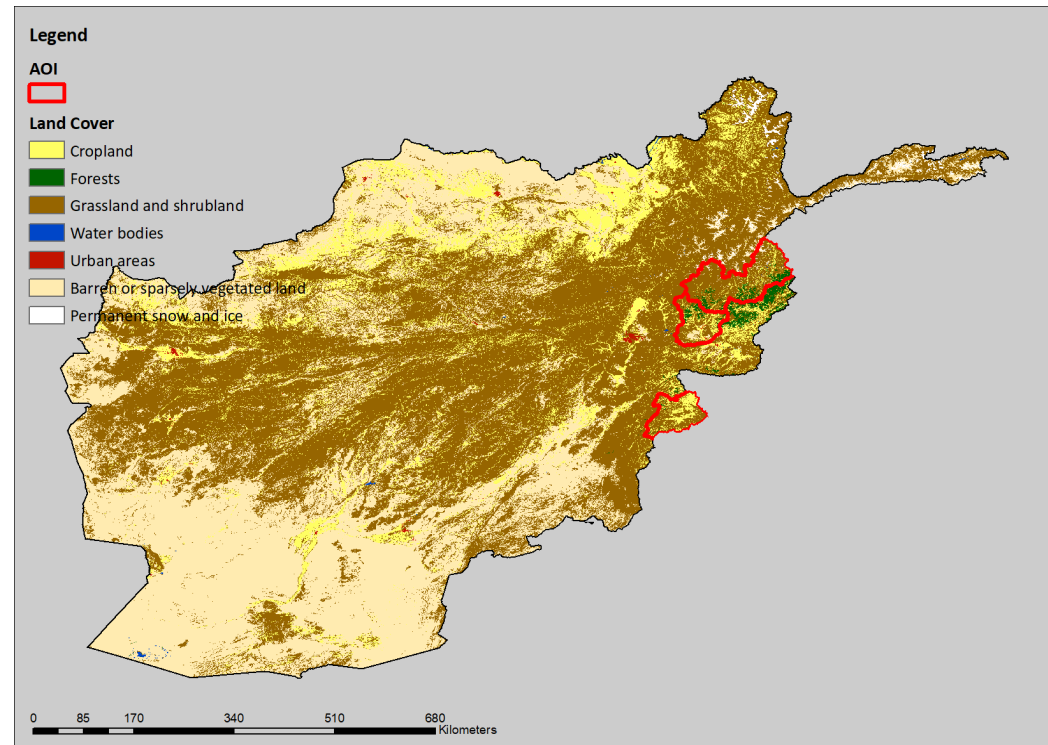
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# The Natural Capital Accounting activities in Eastern Afghanistan

- FAO is currently assisting the Government of Afghanistan, through the Ministry of Agriculture, Irrigation, and Livestock (MAIL), in the preparation of a Global Environmental Facility (GEF) project that aims at addressing land degradation and biodiversity loss by promoting sustainable rangeland management and biodiversity conservation in the three eastern Afghanistan provinces of Khost, Laghman, Nuristan



Three target provinces Areas of Interest (AOI)



# The Natural Capital Accounting activities in Eastern Afghanistan

- This is the first natural capital attempt that ever took place in Afghanistan and that was presented to [the London group on environmental accounting](#), a city group created in 1993 to allow practitioners to share their experience of developing and implementing environmental accounts.
- The London Group generally meets annually, and the meetings provide a forum for review, comparison and discussion of work underway by participants towards development of environmental accounts.
- The FAO GEF paper on selected Eastern Afghanistan provinces was presented at the 26<sup>th</sup> London group meeting, Bonn/virtual, in October 2020



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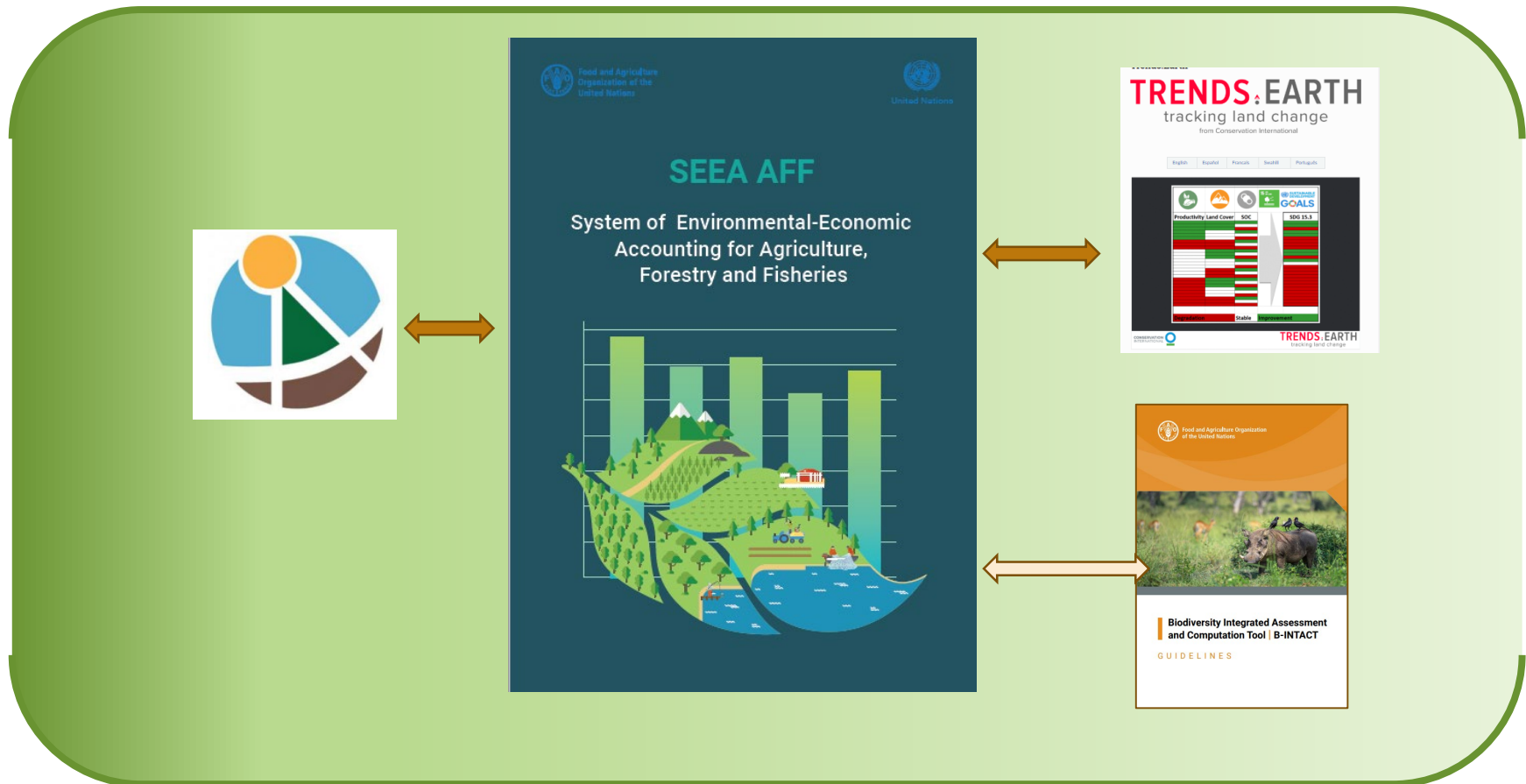
# The Natural Capital Accounting activities in Eastern Afghanistan

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- The natural capital exercise proposed to the London Group was based on the System for Environmental-Economic Accounting (SEEA) framework and in particular on the SEEA for Agriculture Forestry and Fisheries, adopted by the UNCEEA as methodological document in support of the SEEA CF on June 2016 (white cover version) and recently published by FAO and UNSD as [final version](#) on March 2020.
- In particular, by using the SEEA standards and methodologies, different geospatial platforms and tools as Aries, Trends Earth and B-Intact were integrated with national data (MAIL-ICIMOD) and calibrated (QA/QC) with international databases (FAOSTAT).



# The Natural Capital Accounting activities in Eastern Afghanistan



# The Natural Capital Accounting activities in Eastern Afghanistan

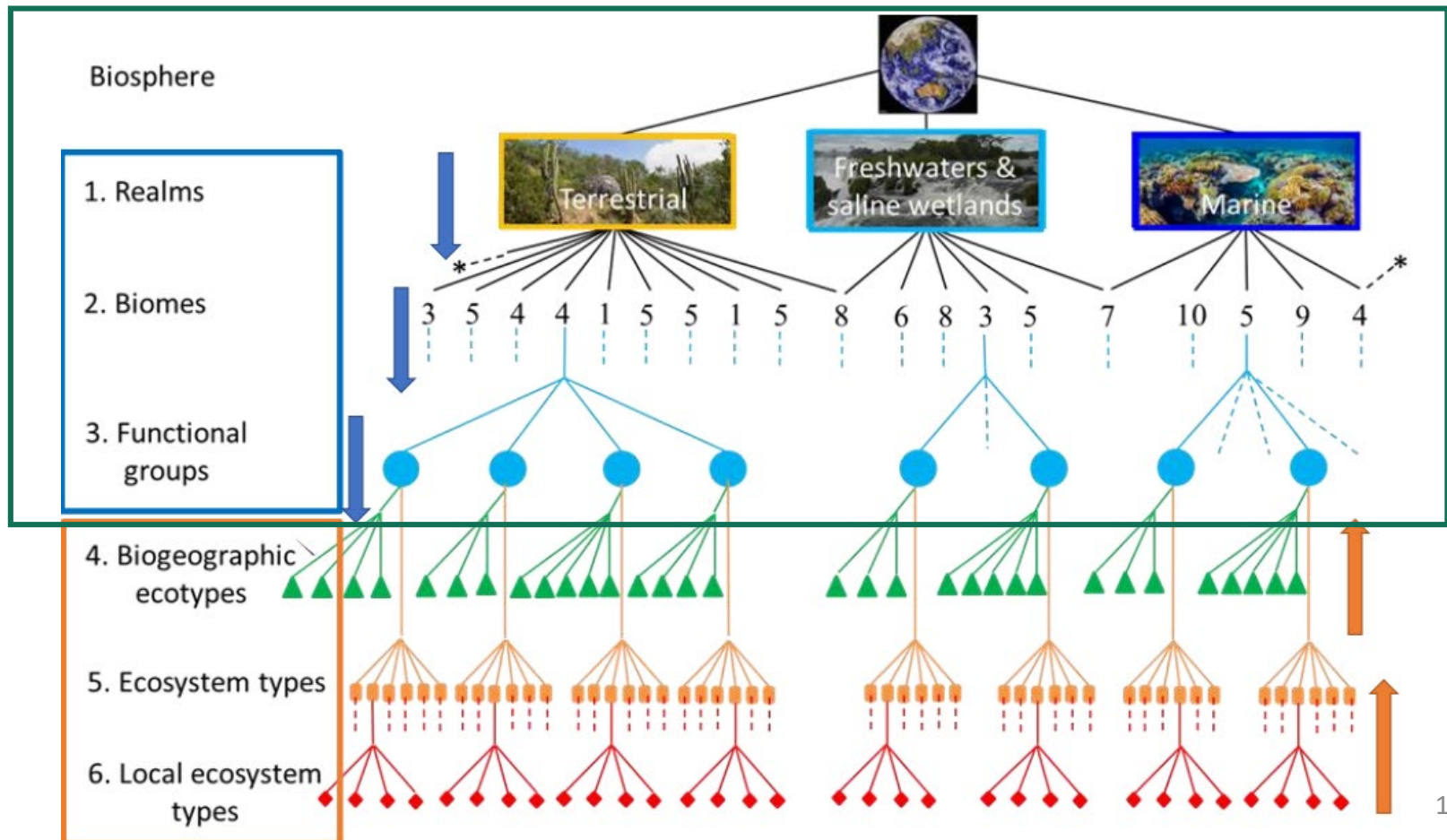
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- The presented paper assesses:
  - ecosystem types, extensions (**topic i**)
  - conditions and derivivation of indicator 15.3.1. (**topic ii**)
  - application of the FAO GEF B-Intact tool for preliminary findings in Biodiversity for Project areas (**topic iii**)



# Ecosystem types and ecosystem extent accounts

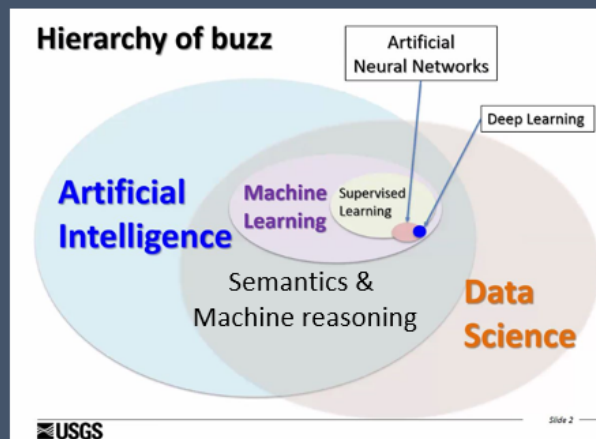
- Ecosystem types as presented in the paper are in line with International Union for Conservation of Nature (IUCN), as suggested by the SEEA (for ecosystem types and its technical recommendations) and in particular its 1-3 level



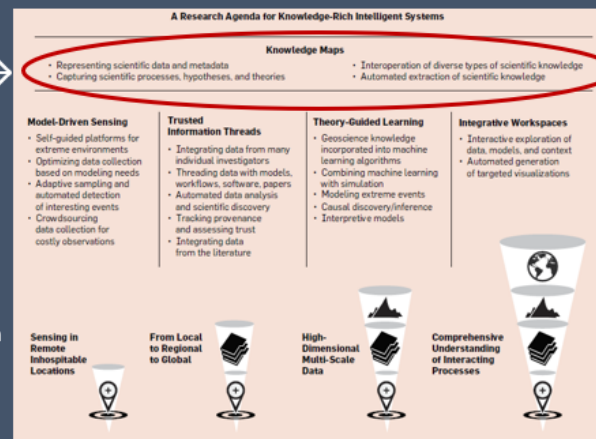
# Ecosystem types and ecosystem extent accounts

- Ecosystem types and their extension over time were computed using the Artificial Intelligence for Environment & Sustainability (ARIES)

## Artificial Intelligence for Environment & Sustainability (ARIES)



Semantics →



Gil et al. 2019. Intelligent systems for geosciences: An essential research agenda. *Comm. ACM* 62:76-84.

Reasoning algorithms

+

Decision rules

+

Multidisciplinary semantics

+

Open data & models

+

Open-source software

=

Fast, FAIR multidisciplinary modeling

Source: Ken Bagstad, Ferdinando Villa, Stefano Balbi, Alessio Bulckaen: *ARIES for SEEA*

# Ecosystem types and ecosystem extent accounts

- Using ARIES and SEEA categories (see paper ANNEX 1) ecosystem types were defined for the three Eastern Afghanistan provinces and related extended account compiled

Ecosystem extent account for Khost Province, Afghanistan, 1992-2018 (km<sup>2</sup>)

Year	Ecosystem type									
	Temperate forest	Young rocky pavement lava flow & scree	Cool temperate heathland	Seasonally dry temperate heath & shrubland	Temperate subhumid grassland	Temperate woodland	Tropical subtropical savanna	Urban ecosystem	Cropland	
1992	59,9	24,7	435,1	161,2	1075,2	573,1	388,8	0,0	1552,7	
2000	52,0	24,9	445,3	160,9	1071,8	572,2	398,5	0,0	1545,1	
2016	52,4	10,6	436,5	154,6	1085,8	593,4	401,5	0,9	1534,3	
2018	50,6	12,1	438,7	157,7	1083,9	586,2	397,1	0,8	1541,6	
Net change, 1992-2018	-9,2	-12,6	3,6	-3,5	8,7	13,1	8,3	0,8	-11,2	



# Ecosystem types and ecosystem extent accounts

Year	Ecosystem type													
	Temperate forest	Boreal/temperate montane forest & woodland	Other desert/semidesert	Young rocky pavement lava flow & scree	Cool temperate heathland & shrubland	Seasonally dry temperate heath & shrubland	Temperate subhumid grassland	Temperate woodland	Tropical subtropical savanna	Polar/alpine tundra	Polar/alpine cliff, scree, lava flow	Urban ecosystem	Cropland	Aquatic
1992	346,6	0,2	736,5	88,3	477,7	54,6	496,0	301,8	227,0	162,4	1,7	5,4	926,3	0,4
2000	350,3	0,2	741,0	89,3	478,1	54,6	493,8	301,3	224,8	162,4	1,7	22,6	904,5	0,4
2016	359,4	0,0	748,5	91,0	452,0	53,0	501,5	311,0	229,2	164,2	1,8	23,6	889,3	0,4
2018	368,1	0,0	745,8	91,0	463,7	51,2	488,9	309,0	219,5	161,1	1,6	24,6	895,6	0,9
Net change, 1992-2018	21,5	-0,2	9,3	2,7	-14,0	-3,4	-7,1	7,2	-7,5	-1,2	-0,1	19,2	-30,7	0,4

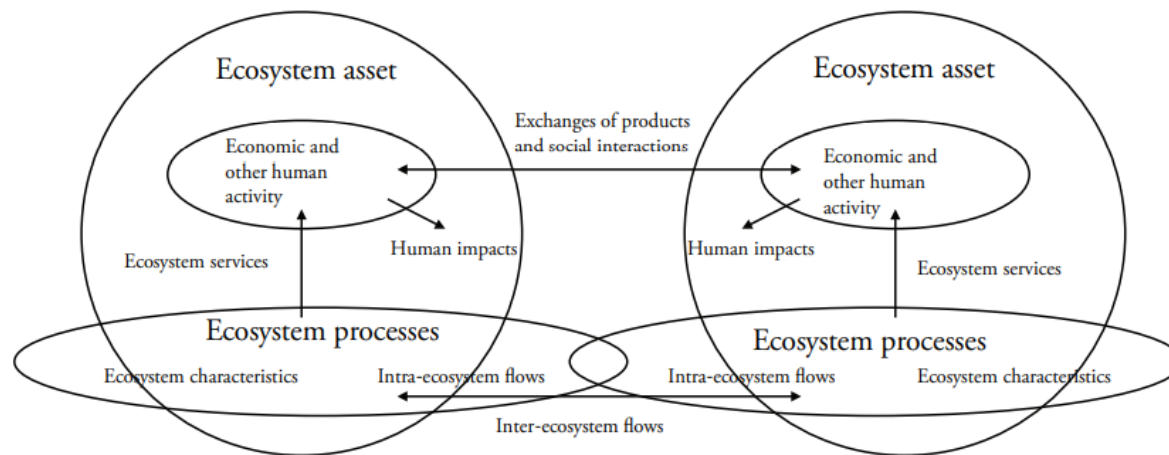
## Ecosystem extent account for Laghman Province, Afghanistan, 1992-2018 (km<sup>2</sup>)

Year	Ecosystem type												
	Temperate forest	Boreal/temperate montane forest & woodland	Young rocky pavement lava flow & scree	Cool temperate heathland & shrubland	Seasonally dry temperate heath & shrubland	Temperate subhumid grassland	Temperate woodland	Polar/alpine tundra	Polar/alpine cliff, scree, lava flow	Ice sheet, glacier, permanent snowfield	Cropland	Boreal/cool temperate palustrine wetland	Aquatic
1992	902,8	2,7	27,4	2917,4	3,3	264,6	277,0	3031,0	469,0	122,6	936,3	8,5	2,3
2000	912,2	2,3	27,4	2922,6	3,3	262,0	275,1	3031,4	469,0	122,6	926,1	8,5	2,3
2016	934,3	2,4	23,4	2895,7	2,8	259,1	303,4	3039,6	423,7	104,9	968,9	8,8	2,0
2018	942,9	2,6	25,7	2878,5	2,6	259,8	278,8	3076,3	436,8	117,6	933,6	6,0	3,0
Net change, 1992-2018	40,1	-0,1	-1,7	-38,9	-0,8	-4,8	1,8	45,3	-32,2	-5,0	-2,7	-2,6	0,7

## Ecosystem extent account for Nuristan Province, Afghanistan, 1992-2018 (km<sup>2</sup>)

# Ecosystem conditions

- Ecosystems can be measured in three perspectives:
  - i. ecosystem extent*
  - ii. ecosystem condition*
  - iii. ecosystem services.*
- Ecosystem condition reflects the overall quality of an ecosystem in terms of its characteristics.



# Ecosystem conditions

- In our paper we have been using Trends.Earth to derive 3 ecosystem conditions:

- i. soil carbon*
- i. land productivity*
- i. land cover change*



- Trends.Earth is a platform for monitoring land change using Google Earth observations (<http://trends.earth/docs/en/>)

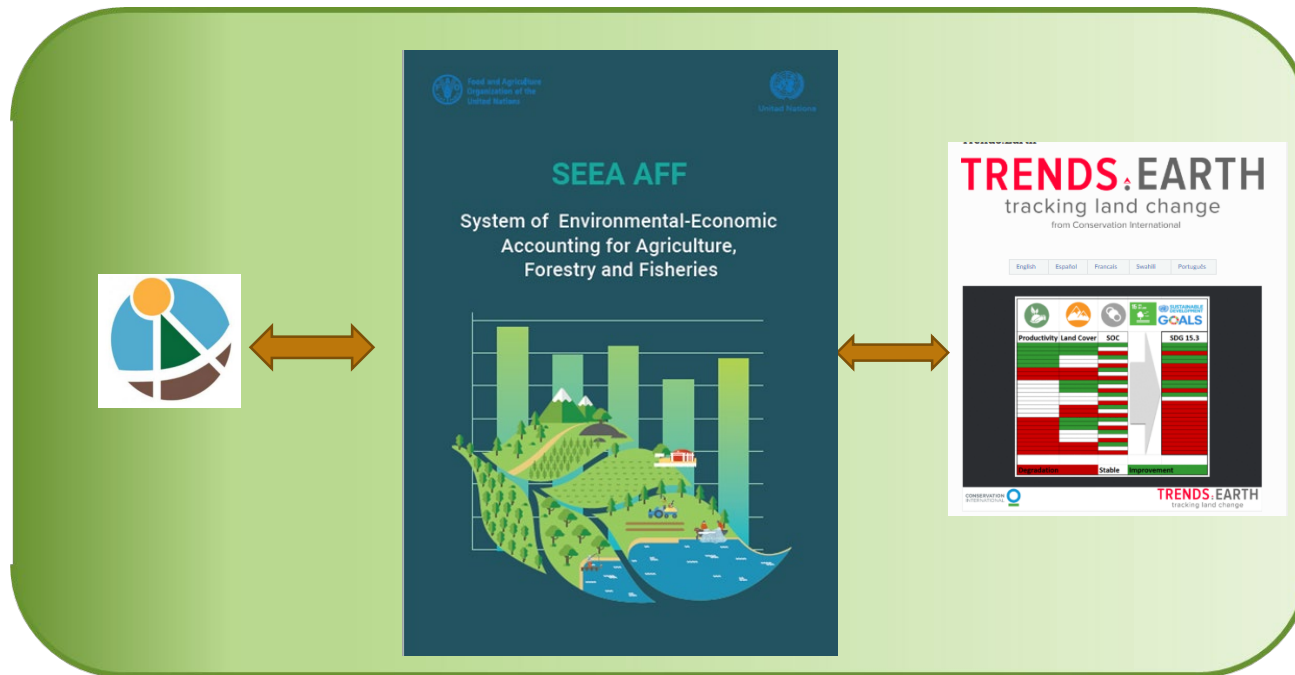


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# Ecosystem conditions

- This tool applies Land cover categories as defined by UNCCD, which are in turn compliant with the Land Cover Meta Language (LCML) and the SEEA (see annex 2 of the presented paper)



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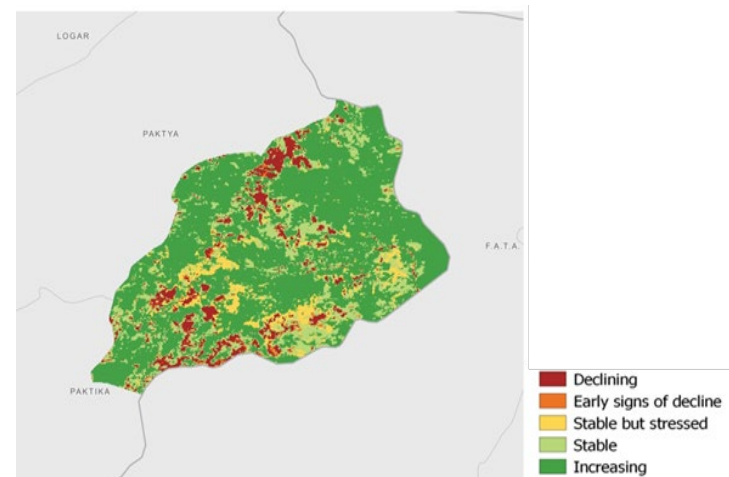


# Ecosystem conditions

## Khost (2001-2010 to 2011-2018)

	Area (sq km)	Percent of total land area
Total land area:	4.033,7	100,00%
Land area with improved productivity:	2.573,9	63,81%
Land area with stable productivity:	843,2	20,90%
Land area with degraded productivity:	616,6	15,29%
Land area with no data for productivity:	0,0	0,00%

	Area (sq km)	Percent of total land area
Total land area:	4.033,7	100,00%
Land area with improved land cover:	20,6	0,51%
Land area with stable land cover:	4.010,3	99,42%
Land area with degraded land cover:	2,8	0,07%
Land area with no data for land cover:	0,0	0,00%



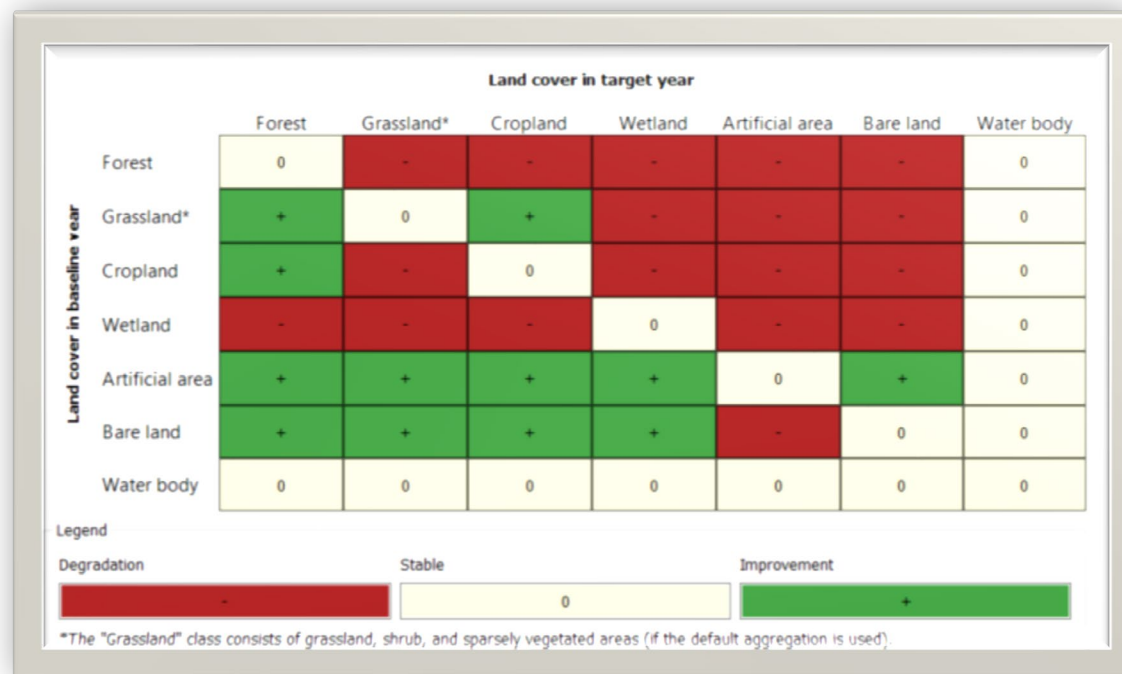
Khost land productivity change (2001-2010 to 2011-2018). Source: Trends Earth



# Ecosystem conditions

**Khost (2001-2010 to 2011-2018)**

	Area (sq km)	Percent of total land area
<b>Total land area:</b>	4.033,7	100,00%
<b>Land area with improved land cover:</b>	20,6	0,51%
<b>Land area with stable land cover:</b>	4.010,3	99,42%
<b>Land area with degraded land cover:</b>	2,8	0,07%
<b>Land area with no data for land cover:</b>	0,0	0,00%



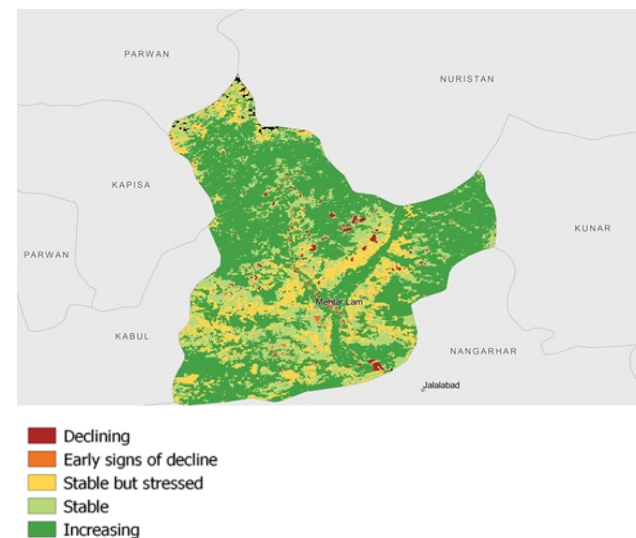


# Ecosystem conditions

## Laghmann (2001-2010 to 2011-2018)

	Area (sq km)	Percent of total land area
Total land area:	3.893,1	100,00%
Land area with improved productivity:	2.671,0	68,61%
Land area with stable productivity:	830,2	21,33%
Land area with degraded productivity:	381,0	9,79%
Land area with no data for productivity:	10,9	0,28%

Laghmann land productivity change (2001-2010 to 2011-2018). Source: Trends Earth



	Area (sq km)	Percent of total land area
Total land area:	3.893,1	100,00%
Land area with improved land cover:	20,5	0,53%
Land area with stable land cover:	3.868,1	99,36%
Land area with degraded land cover:	4,4	0,11%
Land area with no data for land cover:	0,0	0,00%

	Area (sq km)	Percent of total land area
Total land area:	3.893,1	100,00%
Land area with improved soil organic carbon:	9,9	0,25%
Land area with stable soil organic carbon:	3.871,6	99,45%
Land area with degraded soil organic carbon:	1,1	0,03%
Land area with no data for soil organic carbon:	10,6	0,27%

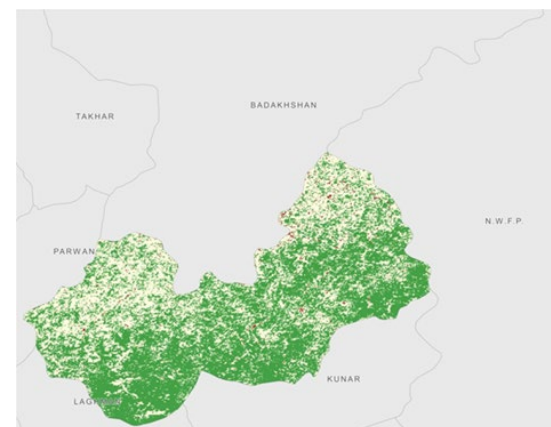


# Ecosystem conditions

## Nuristan (2001-2010 to 2011-2018)

	Area (sq km)	Percent of total land area
<b>Total land area:</b>	8.878,2	100,00%
<b>Land area with improved productivity:</b>	4.111,6	46,31%
<b>Land area with stable productivity:</b>	3.028,4	34,11%
<b>Land area with degraded productivity:</b>	1.131,1	12,74%
<b>Land area with no data for productivity:</b>	607,1	6,84%

Nuristan land productivity change (2001-2010 to 2011-2018). Source: Trends Earth



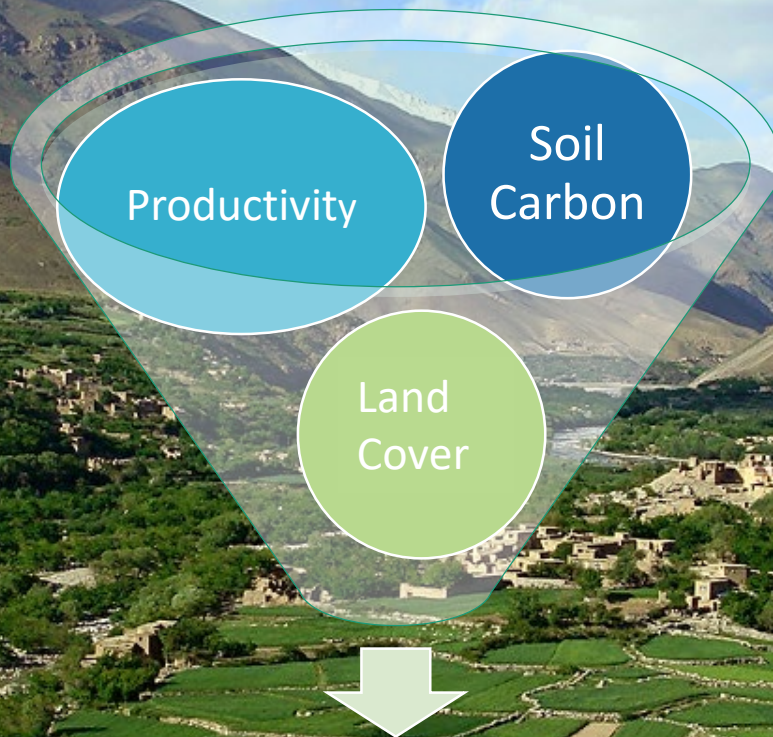
	Area (sq km)	Percent of total land area
<b>Total land area:</b>	8.878,2	100,00%
<b>Land area with improved land cover:</b>	14,1	0,16%
<b>Land area with stable land cover:</b>	8.857,3	99,76%
<b>Land area with degraded land cover:</b>	6,8	0,08%
<b>Land area with no data for land cover:</b>	0,0	0,00%

	Area (sq km)	Percent of total land area
<b>Total land area:</b>	8.878,2	100,00%
<b>Land area with improved soil organic carbon:</b>	2,3	0,03%
<b>Land area with stable soil organic carbon:</b>	8.269,4	93,14%
<b>Land area with degraded soil organic carbon:</b>	0,8	0,01%
<b>Land area with no data for soil organic carbon:</b>	605,7	6,82%





# Ecosystem conditions



## Indicator 15.3.1

Proportion of land that is degraded over total land area

15 LIFE ON LAND



# Ecosystem conditions

## Indicator 15.3.1

Proportion of land that is degraded over total land area

15  
LIFE  
ON LAND



### Khost

	Area (sq km)	Percent of total land area
<b>Total land area:</b>	4.033,7	100,00%
<b>Land area improved:</b>	2.579,1	63,94%
<b>Land area stable:</b>	835,6	20,72%
<b>Land area degraded:</b>	618,9	15,34%
<b>Land area with no data:</b>	0,0	0,00%

### Laghmann

	Area (sq km)	Percent of total land area
<b>Total land area:</b>	3.893,1	100,00%
<b>Land area improved:</b>	2.672,5	68,65%
<b>Land area stable:</b>	822,1	21,12%
<b>Land area degraded:</b>	383,5	9,85%
<b>Land area with no data:</b>	15,0	0,39%

### Nuristan

	Area (sq km)	Percent of total land area
<b>Total land area:</b>	8.878,2	100,00%
<b>Land area improved:</b>	4.093,9	46,11%
<b>Land area stable:</b>	2.971,5	33,47%
<b>Land area degraded:</b>	1.087,4	12,25%
<b>Land area with no data:</b>	725,4	8,17%



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# Ecosystem services – Biodiversity

- “The measurement of ecosystem services implies the attempt of recording the “output” generated by ecosystems, and thus the monetary values which represent exchange values consistent with the principles of national accounting given current uses of ecosystem”
- It is safe to presume that *a complete loss of biodiversity corresponds to an equivalent complete loss of the supply of ecosystem services from a given area of intervention.*
- In this analysis we chose to refer to ecosystem service values as reported in the Ecosystem Services Valuation Database (ESVD), as per **B-INTACT** methodology:

$$SV_p = \left( \sum_{i=1}^{i=n} (MSA_{i,p} * S_{i,p} * ESV_{i,p}) \times MSA_{HE,p} \right) - \left( \sum_{i=1}^{i=n} (MSA_{i,b} * S_{i,b} * ESV_{i,b}) \times MSA_{HE,b} \right)$$

SV<sub>p</sub> = is the added social value of biodiversity due to project implementation

MSA<sub>i,p</sub> = the **MSA** of project activity patch i,

S<sub>i,p</sub> = the surface area of project activity patch i

ESV<sub>i,p</sub> = the **ecosystem service value** of project activity patch i

MSA<sub>HE,p</sub> the project MSA corresponding to the impacts of human encroachment (HE)

MSA<sub>i,b</sub> = the **MSA** of baseline activity patch i

S<sub>i,b</sub> = the surface area of baseline activity patch i

ESV<sub>i,b</sub> = the **ecosystem service value** of baseline activity patch i

MSA<sub>HE,b</sub> = the baseline MSA corresponding to the impacts of human encroachment (HE)



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# Ecosystem services – Biodiversity

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## II. Added Social Value of Biodiversity

**USD 9.733.745**

- It has to be pointed out that the reported Added social value for biodiversity refers to only the 19,800 ha of project activities area which are assumed to accrue across the entire areas of Laghman, Khost and Nuristan.
- Therefore, we can definitively assume that a much higher value could be derived from the above described methodology if the project is scaled up over and above the initial 19,800 ha.



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# Biodiversity – B INTACT – Preliminary findings

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- The Biodiversity Integrated Assessment and Computation Tool is integrated as includes **QUANTITATIVE** and **QUALITATIVE** analytical results

## QUANTITATIVE:

MSA

Antropogenic impact on biodiversity (e.g.: human encroachment)

Added Social Value of Biodiversity

## QUALITATIVE

Biodiversity sensitivity

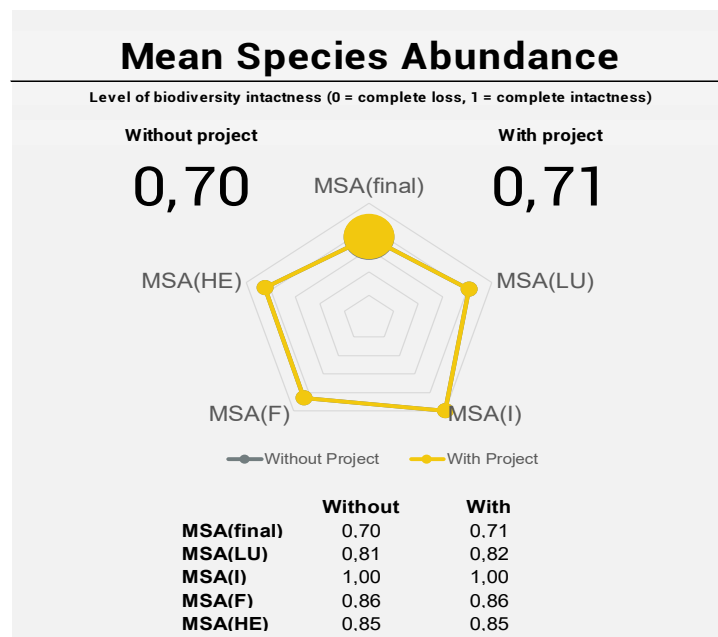
Biodiversity management practices

Both qualitative and quantitative assessments have been accomplished in this analysis



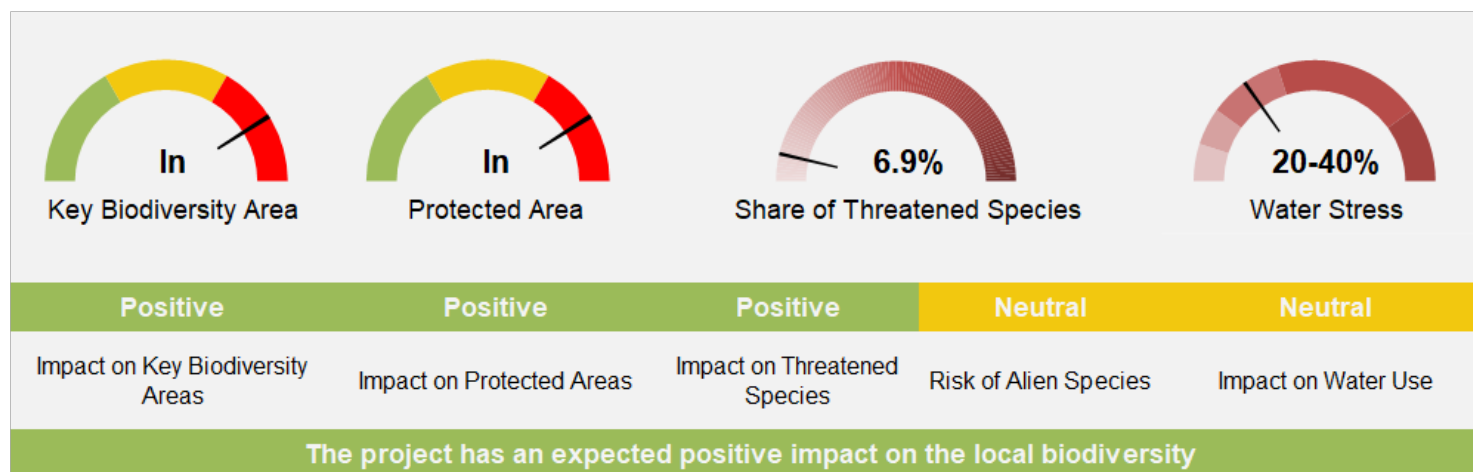
# Biodiversity – B INTACT – Preliminary findings

- The MSA metric, expresses the mean abundance of original species in disturbed conditions relative to their abundance in an undisturbed habitat (where MSA = 1 highlights an entirely intact ecosystem and MSA = 0 highlights a fully destroyed ecosystem).
- MSA is assessed by main pressure: land-use change (LU), infrastructure (I), natural area fragmentation (F), and human encroachment impact (HE),



# Biodiversity – B INTACT – Preliminary findings

- Non quantifiable impacts to biodiversity from project activities are assessed with a qualitative appraisal of the biodiversity sensitivity, management activities and agrobiodiversity practices, to complement the quantitative assessment



# Thank You!

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