System of Environmental Economic Accounting

Extent and condition accounts

Mexico contribution to the SEEA EEA revision process

June 24 2020

INECOL Instituto de Ecología, A.C. | CONABIO Comisión Nacional para el Conocimiento y Uso de la Biodiversidad | integralidad GAMMA | Universidad Nacional Autónoma de México | United Nations | CONAFOR Comisión Nacional Forestal | SEMARNAT Secretaría del Medio Ambiente y Recursos Naturales | INEGI Instituto Nacional de Estadística y Geografía

Extension and Condition bottlenecks

- Spatial framework
- Ecosystem classification

- Data organization
- Reference levels
- Data aggregation
- Reporting

Standardization

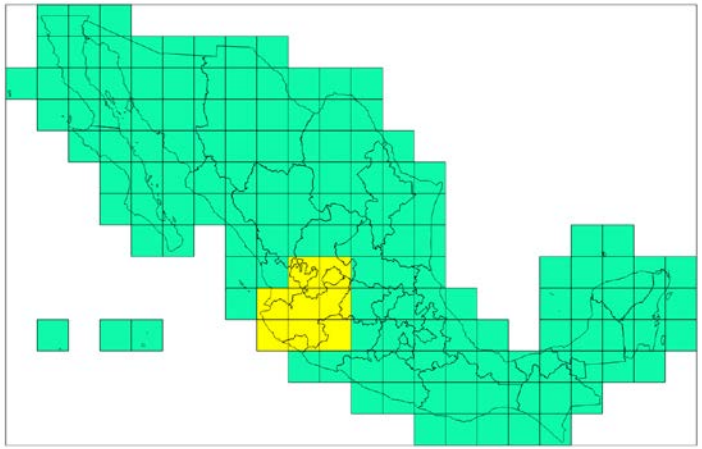
Spatial Framework

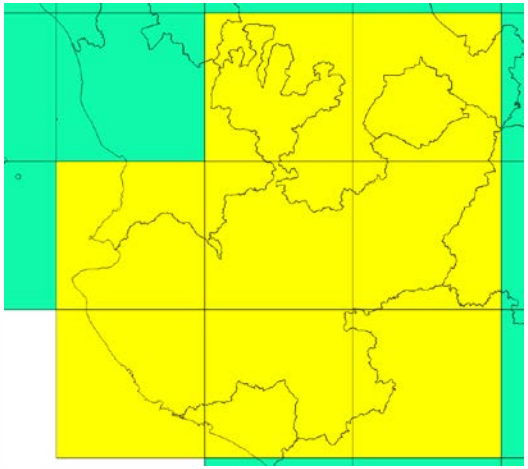
- Cartographic projection that:
  - Spans the whole country
  - Warrants consistent area calculation everywhere
  - It can be used even at Subcontinental level (i.e. North America)

- Raster or vector formats
  - In the case of raster data:
    - Design of extent such that:
      - Consistent nesting can be accomplished.
      - Multiple resolution can be navigated steadily.
    - Guarantees integration and comparability among different types of data

ALBERS EQUAL AREA PROJECTION PARAMETERS (MEXICO)						
Central Meridian 102ºW (-102.0)	Std. Parallel 1: 17º30´N (17.5)	Std Parallel 2: 29º30´N (29.5)	Base Parallel: 12º N (12.0)	False origin Y: 0	False origin X: 2,500,000	Elipsoid: GRS80

+proj=aea +lat_1=17.5 +lat_2=29.5 +lat_0=12 +lon_0=-102 +x_0=2500000 +y_0=0 +ellps=GRS80 +units=m +no_defs





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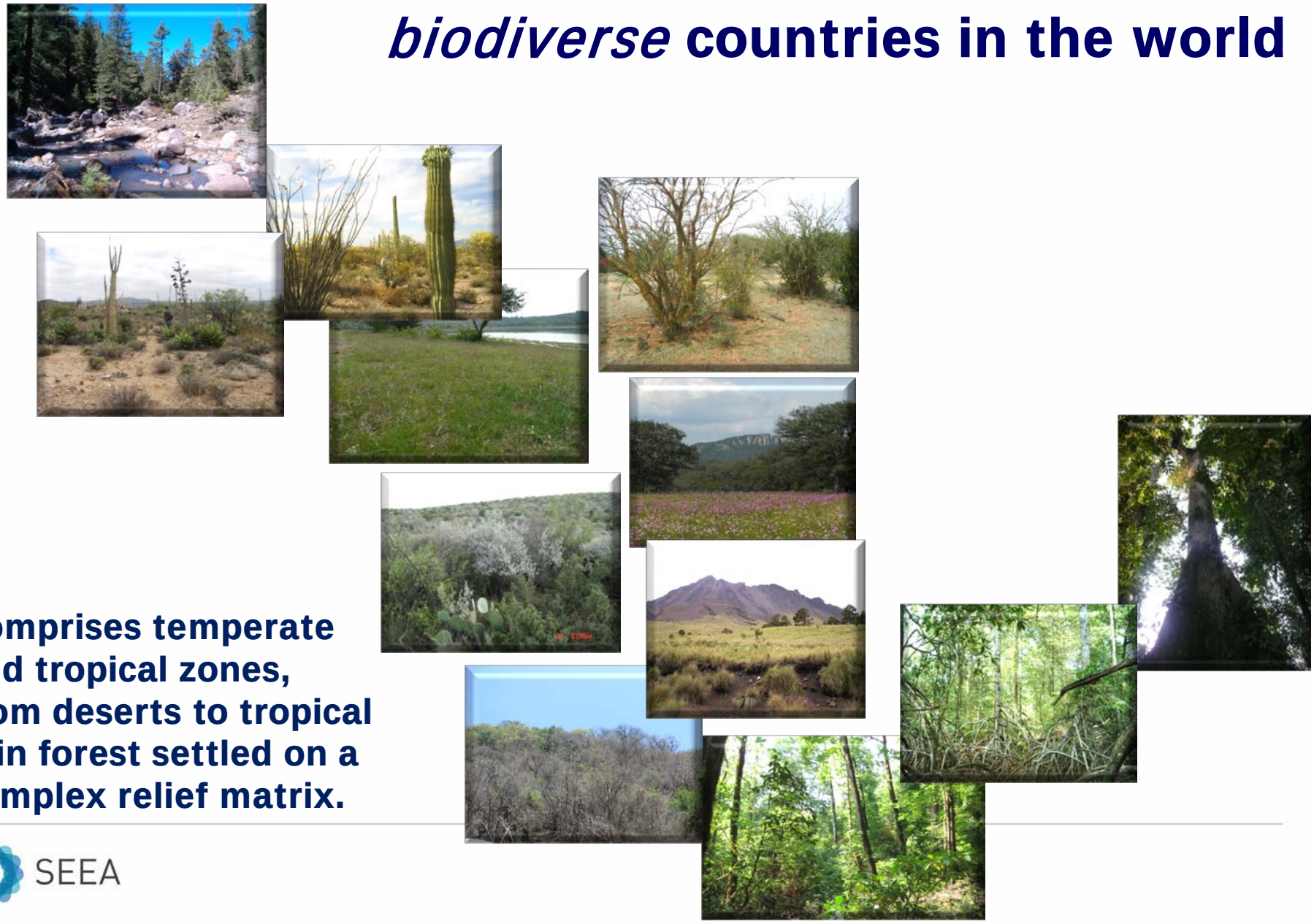
Extension

México is one of the ten most *biodiverse* countries in the world



Comprises temperate and tropical zones, from deserts to tropical rain forest settled on a complex relief matrix.

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Ecosystem Classification

- **National classification approaches**
- Mostly based on Vegetation
- Classification criteria correlates with:
  - > Climate
  - > Structure
  - > Composition
  - > Dynamics (photosynthesis, phenology, etc.)
  - > Soil–water dependent ecosystems.

Cartografic Products considered

- Vegetation Classification (*INEGI Vegetation Series*)
  - > 58 Vegetation types
  - > 30 classes used for **extension**

- Holdridge Life Zones, used for **condition** computation
- Ecoregions: from level 1 to 4 for **regional reporting**

Extension: 30 Ecosystem types

Class_eng_level3
Fisheries and Aquaculture
Cropland, annual crops
Cropland, permanent crops
Settlements
Forest plantation
Conifer forest, primary
Conifer forest, secondary growth
Oak forest, primary
Oak forest, secondary growth
Cloud forest, primary
Cloud forest, secondary growth
Other land cover woody, primary
Other land cover woody, secondary growth
Other land cover non-woody, primary
Other land cover non-woody, secondary growth
Water
Shrubland, woody, primary
Shrubland, woody, secondary growth
Shrubland non-woody, primary
Shrubland non-woody, secondary growth
Other lands
Grassland
Deciduous tropical forest, primary
Deciduous tropical forest, secondary growth
Evergreen tropical forest, primary
Evergreen tropical forest, secondary growth
Semi - deciduous tropical forest, primary
Semi - deciduous tropical forest, secondary growth
Hydrophilic vegetation, woody, primary
Hydrophilic vegetation, woody, secondary growth
Hydrophilic vegetation, non-woody, primary
Hydrophilic vegetation, non-woody, secondary growth

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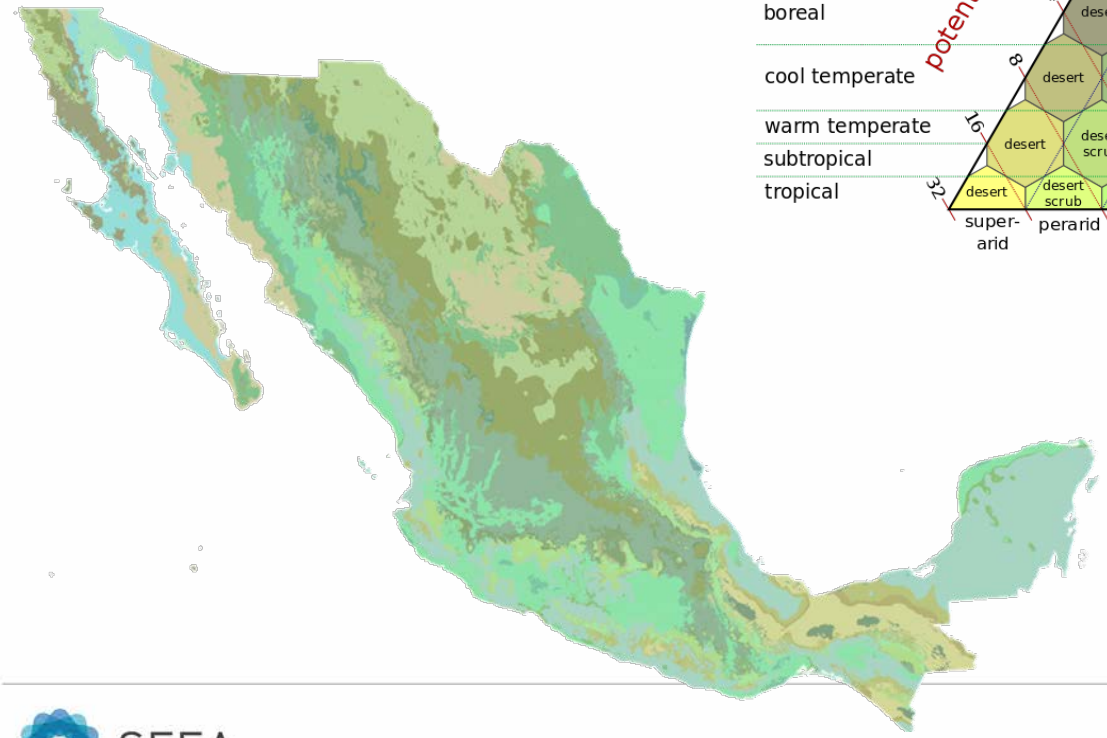
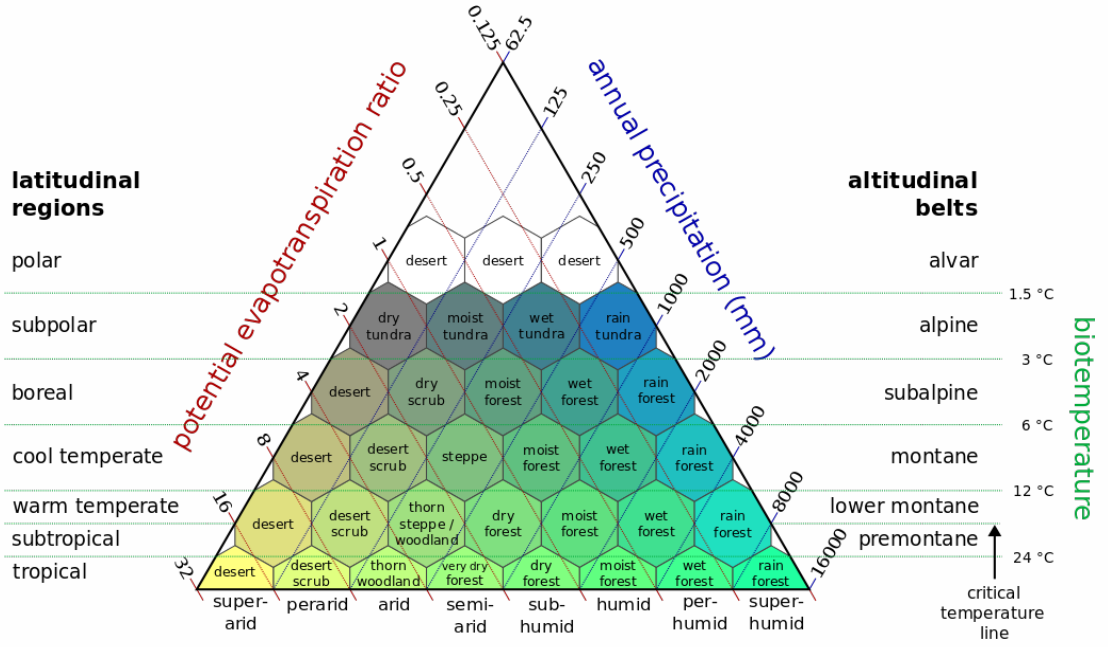
Holdridge Life Zones





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Ecosystem Classification Challenges

- Unified classification for SEEA (extension, condition, services)
- Correspondence tables between all of them (ongoing effort)
- Challenges for IUCN:
  - > Finish crosswalk
  - > What about secondary growth ecosystems???
    - Implications for classification and condition

IUCN Crosswalk to vegetation groups

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	A
				Functional group	T1.1 Tropical/Subtropical lowland rainforests	T1.2 Tropical/Subtropical dry forests and scrubs	T1.3 Tropical/Subtropical montane rainforests	T1.4 Tropical heath forests	T2.1 Boreal and montane needle-leaved forest and woodland	T2.2 Temperate deciduous forests and shrublands	T2.3 Oceanic temperate rainforests	T2.4 Warm temperate rainforests	T2.5 Temperate pyric humid forests	T2.6 Temperate pyric sclerophyll forests and woodlands	T3.1 Seasonally dry tropical shrublands	T3.2 Seasonally dry temperate heaths and shrublands	T3.3 Cool temperate heathlands	T3.4 Rocky pavements, screes and lava flows	T4.1 Trophic savannas	T4.2 Pyric tussock savannas	T4.3 Hummock savannas	T4.4 Temperate wooded savannas	T4.5 Temperate grasslands	T5.1 Semi-desert steppes	T5.2 Thorny deserts and semi-deserts	T5.3 Sclerophyll deserts and semi-deserts	T5.4 Cool temperate deserts	T5.5 Hyper-arid deserts	T6.1 Ice sheets, glaciers and perennial snowfields	T6.2 Polar/alpine rocky outcrops	T6.3 Polar tundra	T6.4 Temperate alpine meadows and shrublands	T6.5 Tropical alpine meadows and shrublands	T7.1 Croplands	T7.2 Sown pastures and old fields	T7.3 Plantations	T7.4 Urban and infrastructure lands	S1.1 Aerobic caves	
1	Major type	map unit #	List of national or regional units																																			
2	Forest		Conifer forest						0.85	0.1				0.05																									
3	Forest		Oak forest							0.8		0.05		0.15																									
4	Forest		Cloud forest				0.8					0.2																											
5	Other types of vegetation		Other types of vegetation		0.25											0.25		0.125																					
6	Xerophilous		Xerophilous shrubland											0.1	0.1	0.2									0.2	0.4												
7	Grassland		Grassland																0.1	0.05		0.2	0.6									0.05						
8	Tropical forest		Deciduous tropical forest			0.8									0.2																							
9	Tropical forest		Thorny tropical forest		0.2	0.6																																
10	Tropical forest		Evergreen tropical forest		1																																	
11	Tropical forest		Semi - deciduous tropical forest			0.85									0.15																							
12	Hydrophilic		Hydrophilic vegetation																																			
13	Induced		Induced vegetation																0.25				0.1													0.25	0.4		
14	Croplands		Croplands																															0.7		0.3		
15	Forest plantation		Forest plantation																																	1		
16	Cultivated grassland		Cultivated grassland																																1			
17	Fisheries and Aquaculture		Fisheries and Aquaculture																																			
18	Water		Water																																		
19	Settlements		Settlements																																		1	
20	Area devoid of vegetation		Area devoid of vegetation																																		1	

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Condition

Condition: Ecosystem integrity index summary

Characteristics	Currently	Future
Realm	Terrestrial	Continental and marine waters
Scope	National (Mexico)	Multi-national
Indicators	Remote sensing and field measurements (Vegetation)	Fauna, degradation by human activities
Type of index	Aggregated (0-100)	Aggregated (0-100)
Reference condition	Based on hemeroby concept	Based on hemeroby concept
Temporal resolution	Multiple time steps: 2004, 2008, 2018	Multiple time steps through an automatized pipeline
Spatial resolution	250 m^2	250m^2

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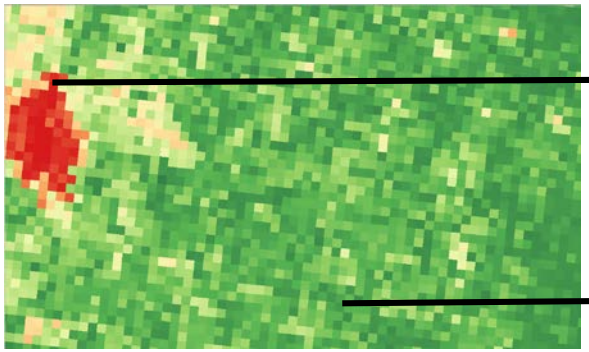
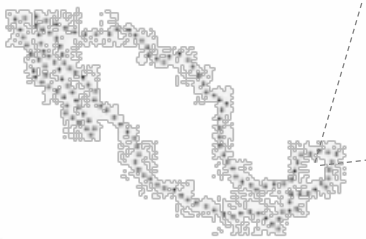
Methodological summary in *White paper* available

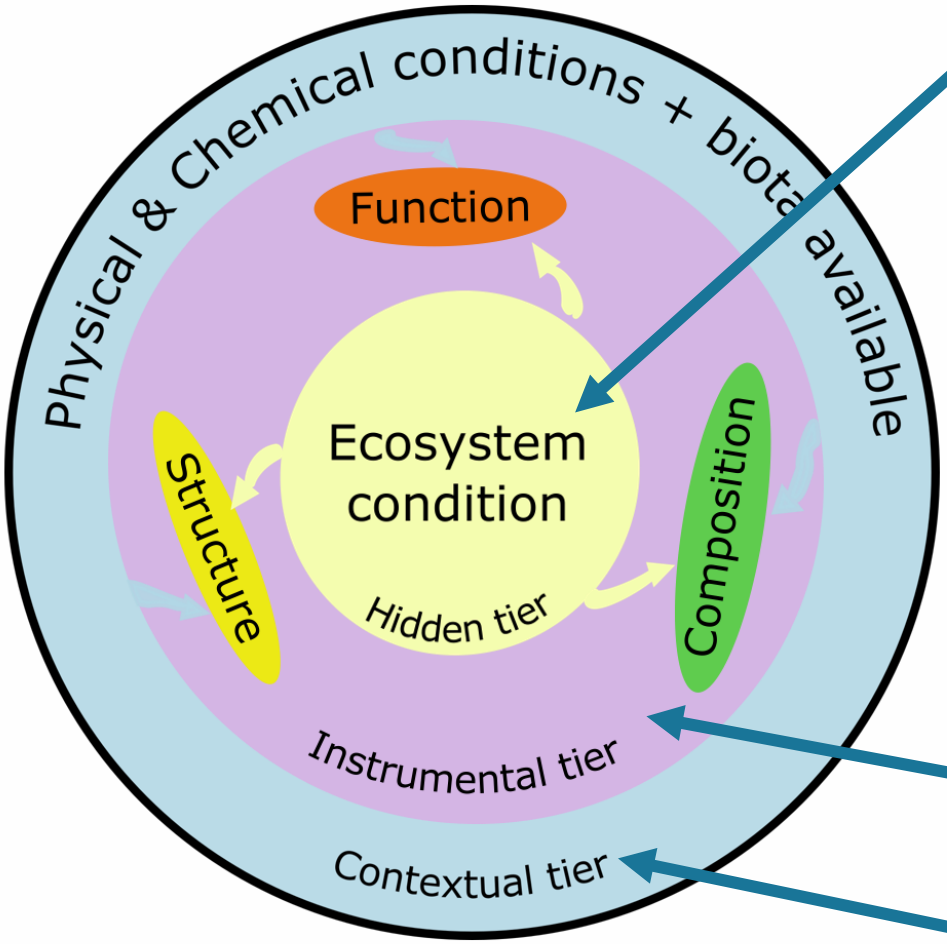
Data: Each pixel is associated to an array of user defined data





EI	% Urban	Average Tree Height	...	Holdridge LZ	IUCN
0.05	94	2	...	TRF	T1.1
0.89	0	8	...	TRF	T1.1

TRF = Tropical Rain Forest
T1.1 = Tropical-subtropical lowland rainforests



- Bayesian network training, instead of score aggregation
- Hemeroby data used to prime the training process.

Ecosystem integrity: *Three tier conceptual model*

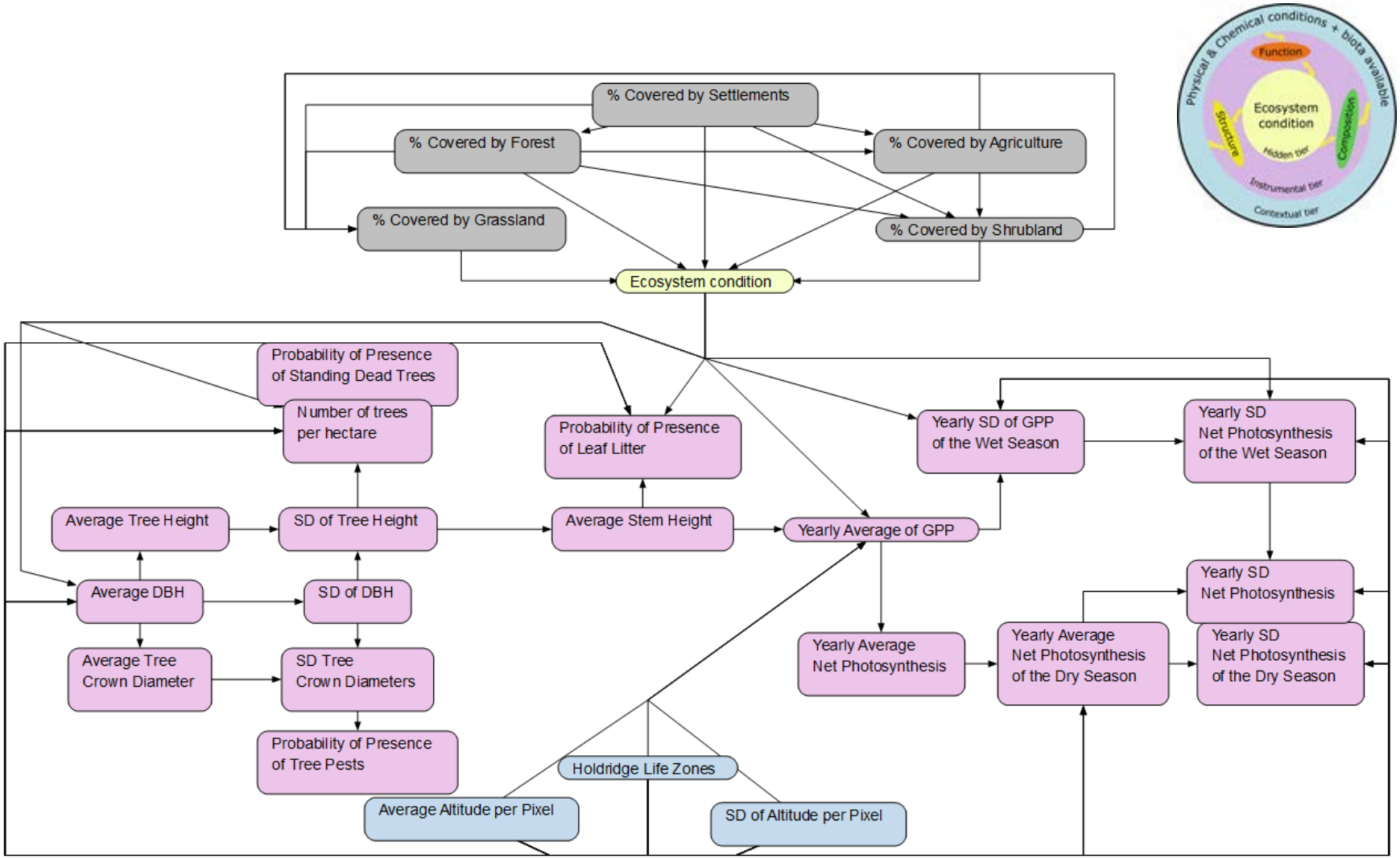
- 3T-CM -

Biotic ecosystem characteristics (functional and structural)

Abiotic ecosystem characteristics

Bayesian network

- Represented as a graph with nodes and links (no loops: *acyclic graph formalism*)
- Links among nodes depict the **causal proposition** assumed: here the 3T-CM
- Nodes have conditional probability tables specifying the influence interactions.


% Covered by Settlements
% Covered by Forest
% Covered by Agriculture
% Covered by Grassland
% Covered by Shrubland
Ecosystem condition
Probability of Presence of Standing Dead Trees
Number of trees per hectare
Probability of Presence of Leaf Litter
Yearly SD of GPP of the Wet Season
Yearly SD Net Photosynthesis of the Wet Season
Average Tree Height
SD of Tree Height
Average Stem Height
Yearly Average of GPP
Average DBH
SD of DBH
Yearly SD Net Photosynthesis
Average Tree Crown Diameter
SD Tree Crown Diameters
Yearly Average Net Photosynthesis
Yearly Average Net Photosynthesis of the Dry Season
Yearly SD Net Photosynthesis of the Dry Season
Probability of Presence of Tree Pests
Holdridge Life Zones
Average Altitude per Pixel
SD of Altitude per Pixel
Physical & Chemical conditions + biota available
Function
Ecosystem condition
Structure
Composition
Hidden tier
Instrumental tier
Contextual tier

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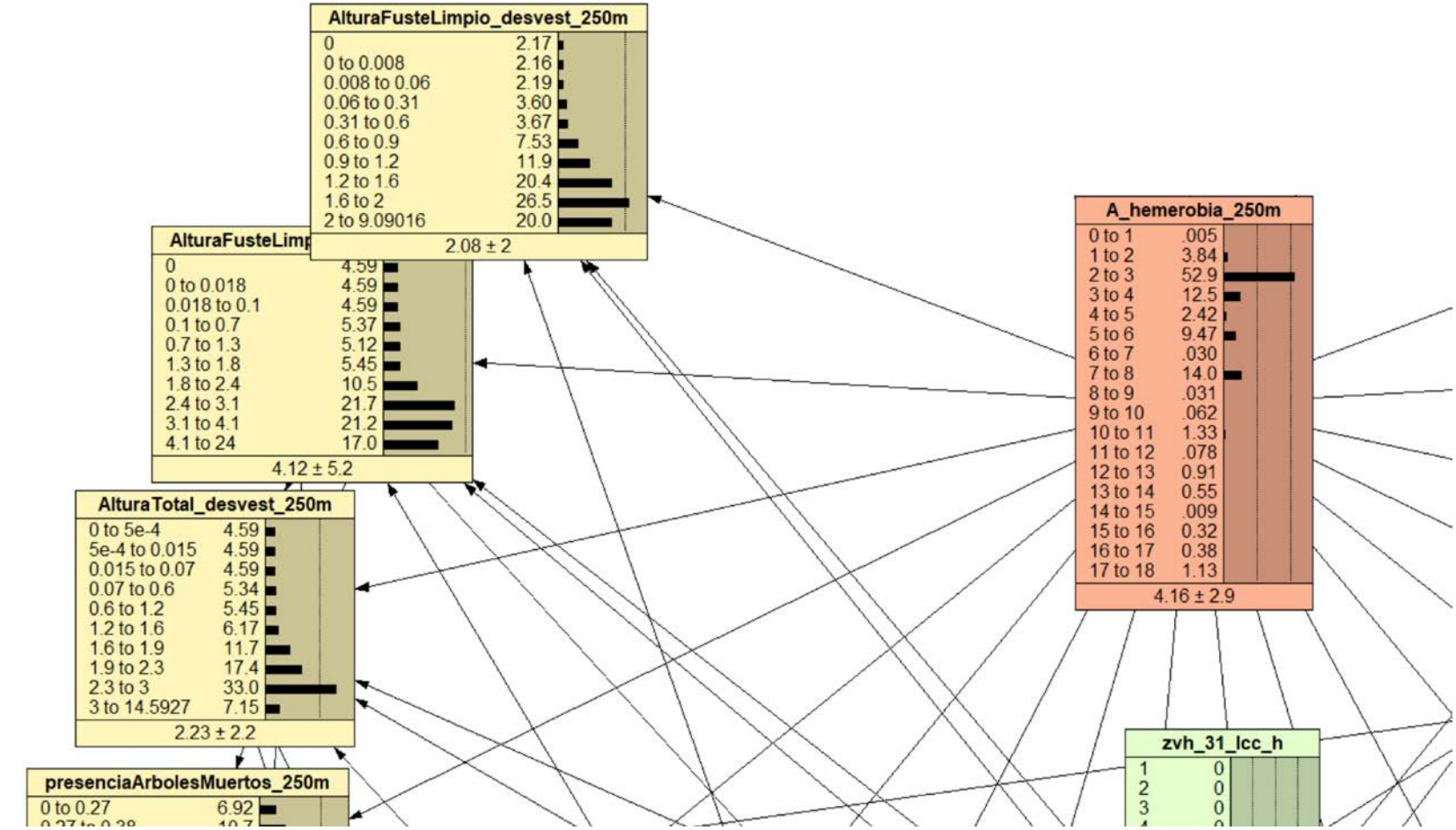
Each node produces a probability for each value, considering the evidence given



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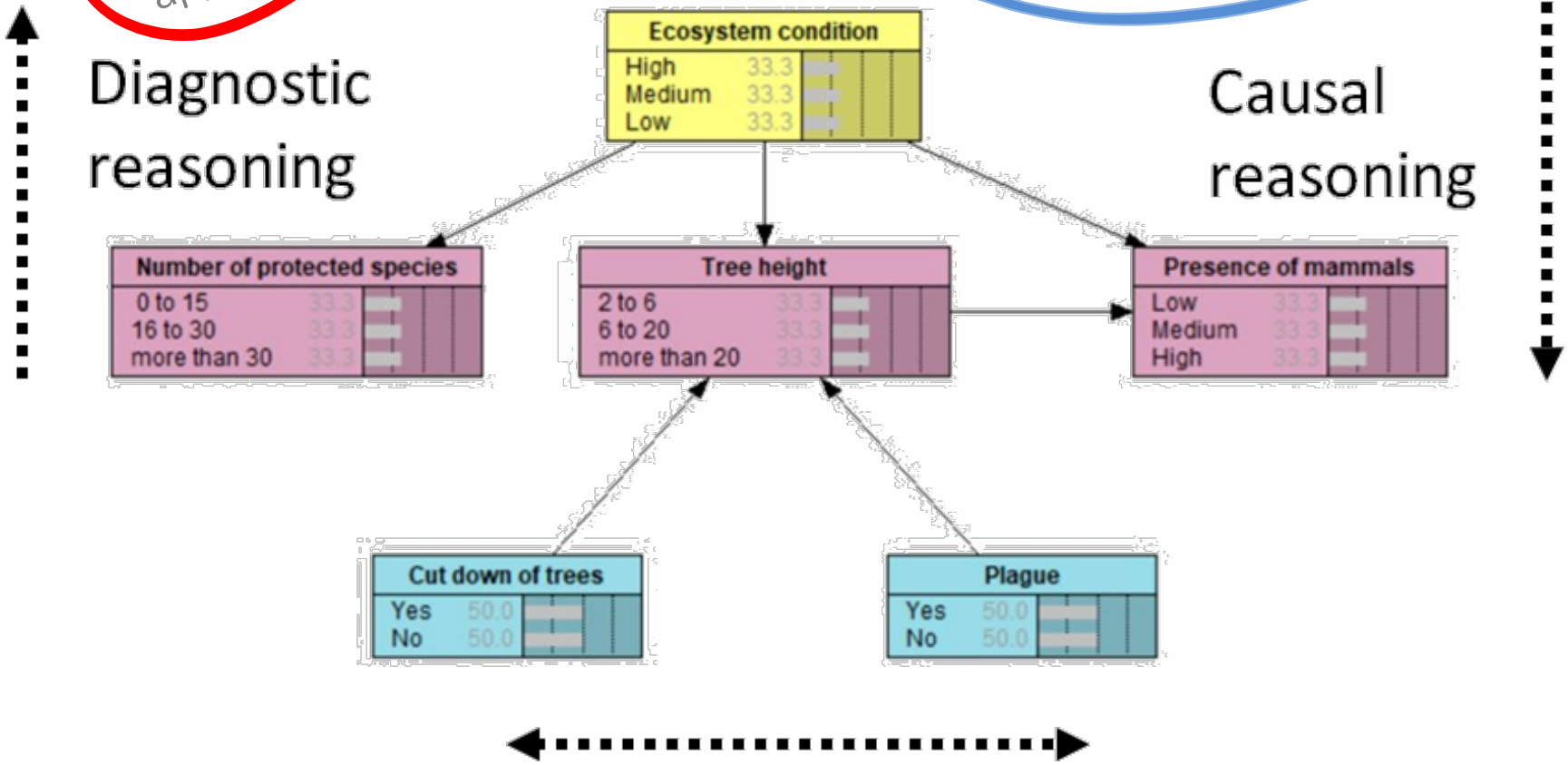
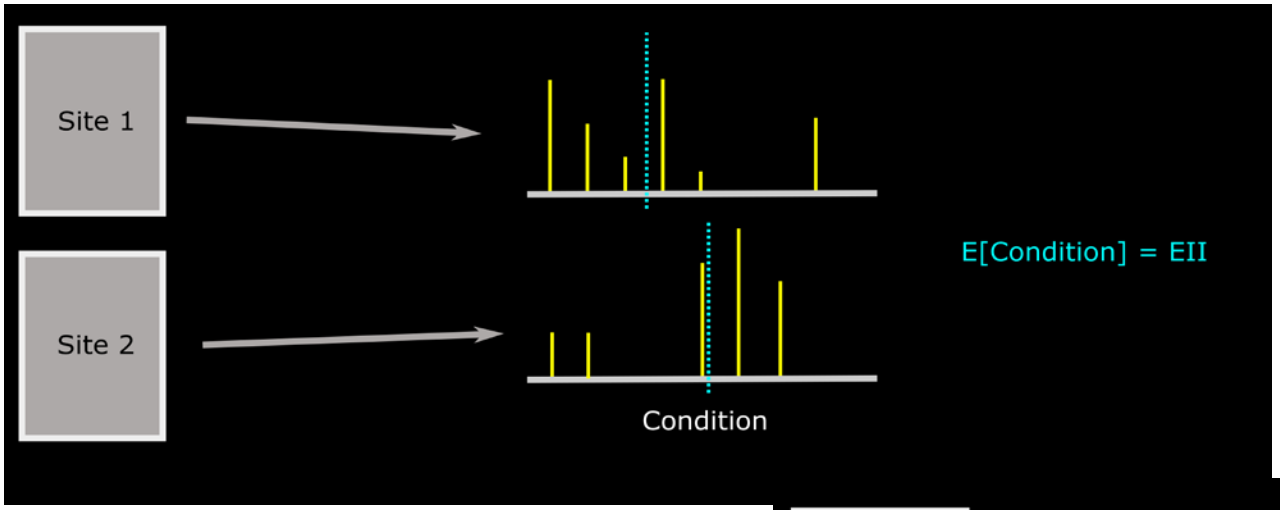
Aggregation = Reasoning types

Current SEEA approach

Data driven training of BN. All forms of reasoning possible

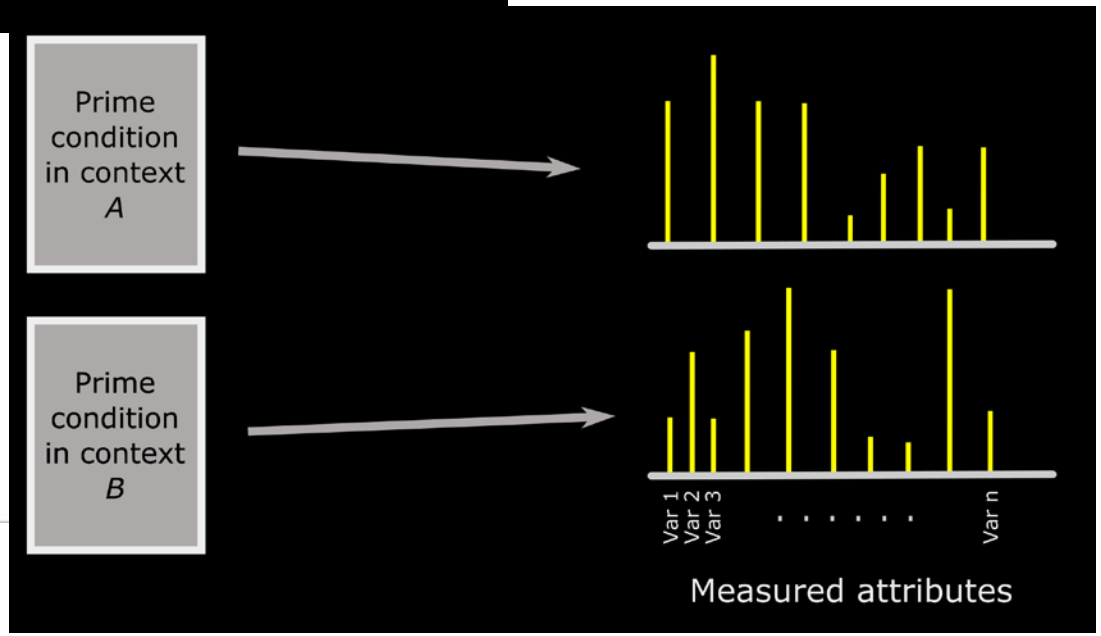


Reference values and Condition computation



Computation of
Ecosystem Integrity Index

Reference values available
through
causal reasoning



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Integridad Ecosistémica para el año 2004

CONABIO
COMISIÓN NACIONAL PARA EL CONOCIMIENTO Y USO DE LA BIODIVERSIDAD

CONAFOR
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Remarks

- National extent and projection parameters for geo-database established.
- Data driven computation of condition using Bayesian networks.
- Use of best biotic and abiotic data available in Mexico.
- Pixel data can be queried for different summaries and products relevant to SEEA.
- Ecosystem condition can be assessed for different ecosystem classification schemes, depending on user needs.