

❖Standard 6: Develop assessments/ visions within ecologically meaningful areas adopted or adapted from existing ecoregional classifications.

Case Study: **Refining Ecoregional Boundary and Subunit Delineations Through the Incorporation of New Data in the Selva Maya, Zoque and Olmeca Ecoregion**

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Purpose and region of analysis

The Selva Maya, Zoque and Olmeca ecoregional assessment includes several ecoregions in Belize, Guatemala and Southeastern Mexico. The original ecoregions, as defined by CONABIO-WWF (1998), utilized a very coarse level of data. The assessment team felt that the boundaries needed to be revised to more accurately reflect the general landscape features using better and finer-scale available data.

Criteria/Methods

The WWF ecoregional boundaries in this region were derived from data at a scale of 1:4 million. When compared to the currently available 1:250,000 scale data, discrepancies were numerous and often dramatic. The boundaries were deemed unacceptable, and the Selva Maya planning group carried out an extensive process to update, revise and subdivide available boundaries to ensure assessment and planning would take place within more ecologically meaningful areas. The steps of this process included several iterations of data integration, expert input/review, and boundary modification.

The first step in the boundary modification process involved identifying major inconsistencies between the CONABIO-WWF ecoregion boundaries and available 1:250,000 scale data (e.g. vegetation maps, geology, etc.). This step also included revising existing literature on ecoregions but the concepts were surprisingly vague and there were not explicit criteria documented to define them.

Three types of errors were identified in original ecoregional boundaries.

1. *Data resolution.* Ecoregions were identified at large scale (1:12 million to 1:4 million), but now data is available at 1:250,000 (Fig 1).
2. *Inaccurate delineation.* Original ecoregions contained uncharacteristic systems. For example, a wetlands ecoregion included hilly and forested areas, and a lowland humid tropical forest ecoregion included areas of high mountain forests.
3. *Inconsistency in creating aggregations of natural communities.* Some ecoregions differentiated between freshwater and coastal wetlands while others did not.

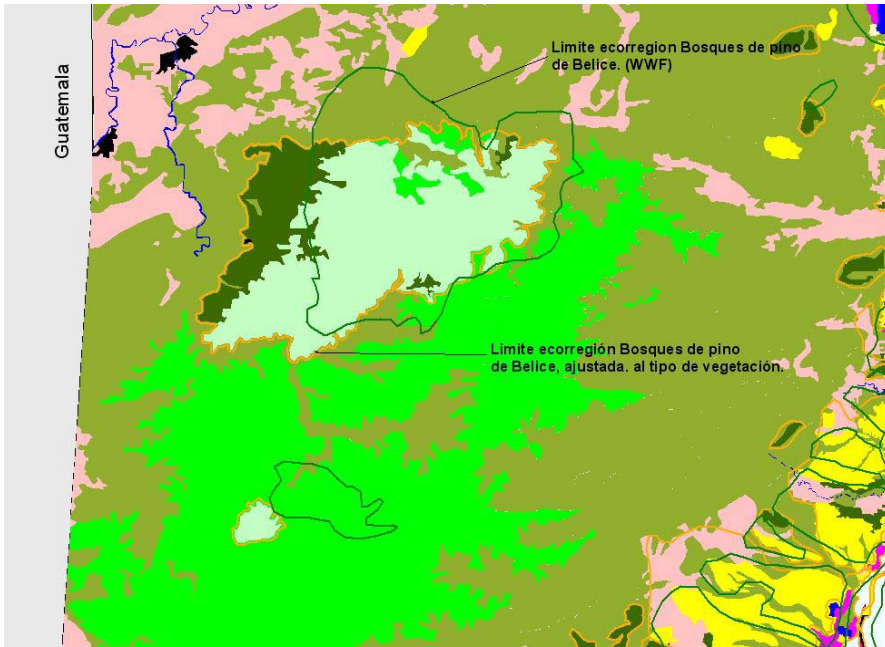
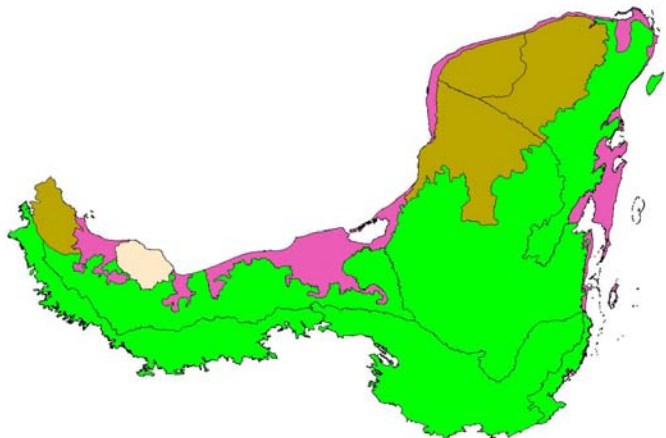


Figure 1. Example of discrepancies between polygons derived from spatial data and different scales. The green lines were drawn at 1:1 million whereas the orange lines were drawn at 1:250,000. Polygons are superimposed on a vegetation map.

The second step consisted of integrating information from three countries and seven Mexican States at 1: 250,000 scale. Integrated maps of vegetation, soils, geology, geomorphology, topography, hydrology, climate, and temperature data were compiled for the region. All data needed cross-walking to resolve differences in classification among countries. Based on the integrated information, two important maps were created, the Morphoedaphology map and the Potential Ecosystems Map. All these processes of integration and new analysis took nearly one and a half years to complete.

The improved maps were used as the basic data to delineate subunits of the ecoregions. The criteria to create the subunits were:

1. Differentiate the main habitat types in the planning unit into:
 - a. Wetlands (coastal and freshwater)
 - b. Lowland tropical humid forest
 - c. Lowland tropical dry forest
2. Differentiate these large landscapes according to different gradients of humidity and geomorphology which differentiates structure and species compositions of ecological systems. For example:



- a. Mangroves in Veracruz and Tabasco are feed by large rivers, providing high levels of sediments, and grow in high quality soils. Mangroves grow up to 40 m.
- b. Mangroves in Yucatan Peninsula are feed by underground water, with less organic materials and grow in karstic soils. Mangroves here grow up to 10 m and some have “dwarf” (enanos) mangroves, which do not grow more than 1 m.
- c. Mangroves in Belize are fed by rivers, and grow on karstic soils, generating a different structure.

This concept for subdividing is critically important for ecoregional planning, because it is important to have viable occurrences of mangroves of each type in the portfolio. Therefore a planner sets goals for each target within subunit to capture environmental gradients.

- 3. Define unit boundaries using the ecological systems cover, which practically identified those vegetation types that occur primary in lowlands or slopes of mountain. Ecological systems that occur in medium to high altitudes start to occur in a range from 900 to 1400 m, therefore we decided to exclude those that occur at that range or higher, and include that occur at that range or lower.

Note: this criteria was not used as explicitly and step-by-step at the beginning, but when we revised the final results, we synthesized the criteria used along the process, and now we can present them in the above order.

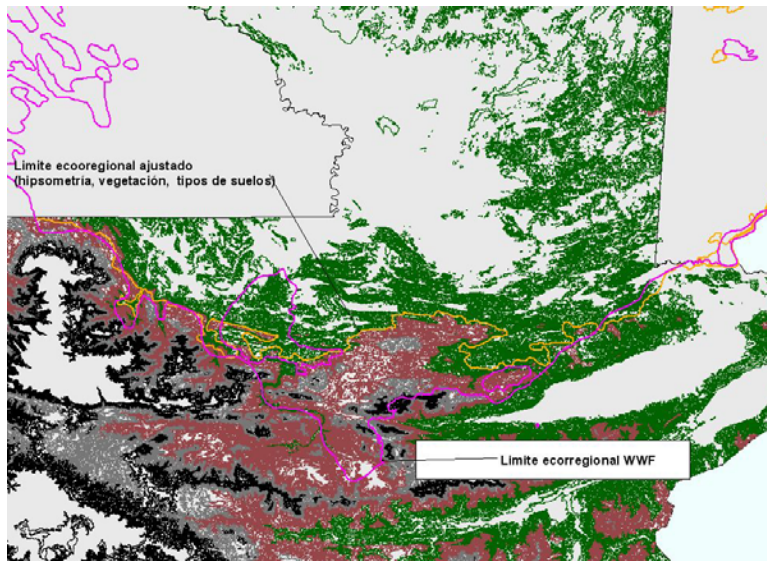
The Operations Team delineated the above listed units and identified areas where inconsistencies were apparent. These areas were highlighted, discussed and solutions proposed in an expert workshop with scientists from all three countries. Experts were divided into 3 groups based on their geographic expertise. Each group was asked to identify the location of all inconsistencies, the nature of each inconsistency, revise the information provided (above mentioned layers), propose changes to be made for each, a justification for these changes, and finally, the assignment of a confidence/accuracy value for each proposed change. The confidence/accuracy value ranges from 1 to 4, where 4 indicated when the team felt confident in the accuracy of the proposed modification and, 1 indicated minimal confidence. Also associated with the value was the source(s) of information that lead to the assignment of that accuracy value. Sources could be biological or physical data. Remediation of inconsistencies included various outcomes such as redrawing boundary lines, proposals for further analyses necessary to determine boundary location or identification of outstanding questions

An excerpt from the table that came out of the first round of expert workshops held to update the ecoregional boundaries within the Selva Maya, Zoque and Olmeca planning region.

	PLACE	INCONSISTENCY	CHANGE MADE	JUSTIFICATION	ACCURACY VALUE
		MONTANE AREA OF VERACRUZ, TABASCO, OAXACA AND			

	PLACE	INCONSISTENCY	CHANGE MADE	JUSTIFICATION	ACCURACY VALUE
		CHIAPAS			
1	Veracruz Dry forests	Ecoregional boundaries do not respond to any obvious criteria; they may have been based on original vegetation.	No changes were made.	Does not affect analysis given the degree of change in land use. No changes necessary, but important to note that it should be considered as one distinct unit.	3. There are Pronatura Veracruz, INECOL databases.
2	Tuxtla Mountains	Ecoregional boundaries do not respond to any obvious criteria. Boundary followed forest cover existing at that time (1980s).	New boundaries proposed correspond to the morphoedaphological analysis.	The Tuxtla Mountains are a relief of tectonic origin in the middle of the great plains of the gulf, isolated from the rest of the mountains and ranges of central Mexico. It is an area of high endemism, comprised of a mosaic of low and tall forest, cloud montane forest and wetlands. This mosaic is valuable for its isolation and complexity, forming a distinct unit. Degrees of humidity, soil and geology are elements that determine the vegetation of the Tuxtla Mountains, variables represented in the morphoedaphological map with all boundaries identified there. The change in boundaries does not affect the analysis since there are no natural areas within the original and the new boundaries (high degree of change in soil use).	4 Publications, it is one of the most studied areas of Mexico.
3	Peten Veracruz Ecoregion in Mexico	An extense area beginning from the Usumacinta basin to the Sierra Madre in Veracruz. Geological and soil variations suggest changes in the vegetation that they support.	Divide alluvial plains of pre-montane karstic outcroppings, following the morphoedaphological units.	Plain was divided following the great morphoedaphological unit to which the plain belonged from Campeche to Veracruz, the pre-montane zones, formed of a mosaic of karstic formations and metamorphic rocks.	2 Based on cartography. There is no data on vegetation changes; the zone is very altered.

An example of boundary modifications determined using new physical data. In this case, adjustments were made using hypsometry and soils data. The pink line represents the original boundary and the yellow line describes the modification.



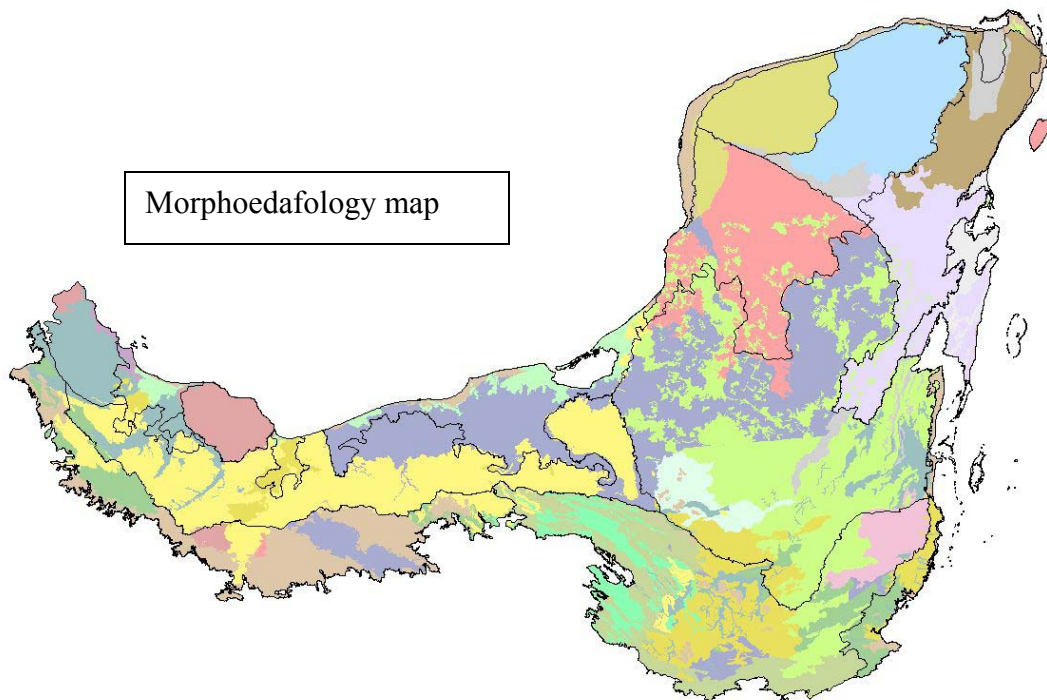
Changes identified in the expert workshop were incorporated into the boundary map by the Operations Team. With a revision completed the team again returned to the experts for final input. Two additional expert meetings were held in order to receive feedback on the boundary revisions and to identify any outstanding issues. Justifiable changes were incorporated into the final version of the boundary map.

Products/Outcomes

The Selva Maya Planning region, which originally contained 13 ecoregions, is now divided in 18 subunits, differentiated by structure, species composition and size. These subunits served to determine distribution of conservation goals. The team avoided naming ecoregions to the newly created subunits because there is an ongoing debate among partners about the new ecoregions map for Mexico. As a resolution the team opted to consider the new units subdivisions of the predetermined, though now modified, ecoregions.

Tools

Morphoedafology Analysis . The Operations Team conducted a Morphoedafology Analysis, which identifies large landscapes from an integration of soils, geomorphology, natural vegetation and climate. Each landscape captures one ecological community type, or an aggregation of highly related communities. The subunits used in the Selva Maya, Zoque and Olmeca assessment are largely based on boundaries identified through this analysis (see map).



Potential Ecological Systems Map: Some limits were originally defined by vegetation type using 1992 vegetation covers, but in many locations there was not vegetation cover, but agriculture and pasturelands. The Operations Team, based on Primary Vegetation Map for Mexico and on Morphoedafology Map for the entire planning unit, developed a Potential Ecological Systems Map (with the primary purpose of helping to define conservation goals of ecological systems). The final limits of some areas, like the Dry Forest of Veracruz, were defined using the Potential Ecological Systems Map.

Strengths and weaknesses

This analysis took a lot of effort including time, expertise and resources. It cost about US\$ 150,000 to generate the base information. However, the product was useful for so many other analyses and purposes. Teams should assess available resources to see if capacity exists within an ecoregional assessment's allocated resources.

The result of this process was a solid proposal produced from high quality base information and expert opinion. As a result, there is wide support and acceptance of the proposal.

Suggestions for others

1. Consider that subunits are important factor in defining portfolio design by determining the areas of assessment, defining classes of conservation targets (as

- with ecosystem classification), and they are the basis for setting conservation goals for targets.
2. Create a clear set of criteria and a sequence to follow as a guide, although it will be likely you will change them during the process.
 3. Develop or compile solid base information to inform decisions. Experts have a “hint” of limits (they have observed some species) but do not have certain knowledge of the location of system boundaries. In this case, the morphoedaphology map helped experts find the limits based on solid information.
 4. Note: If you do not have all necessary information, think creatively. For Central America, where we have information from 8 countries, we may not be able to integrate and crosswalk all the information at 1:250,000 scale, so we may be using information from each country separately.

References

REVIEW OF THE ECOREGION BOUNDARIES AND DEFINITION OF PLANNING SUB-UNITS REPORT by Secaira, Fernando. Part of a series of reports of the Ecoregional Plan of the MAYA, ZOQUE and OLMECA Forest (a process led by Defensores de la Naturaleza, El Colegio de la Frontera Sur, Pronatura Península de Yucatán, Programme for Belice, Conservation International, The Nature Conservancy, Wildlife Conservation) Society.