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THE FAO – UNEP LCCS
(LAND COVER CLASSIFICATION SYSTEM)

BY

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PRESENTATION CONTENTS:

- ***Background***
- ***LCCS 2 VS LCCS3***
- ***UML VS XML***
- ***LCCS 3 OVERVIEW***
- ***LCCS 3 IN THE OPERATIONAL CONTEXT***

L.C. SEMANTIC THE CORE OF THE PROBLEM:

- **Many classifications of geographic phenomena are often a black box to anyone outside the immediate group involved in the classification process.**
- **In geographic information truth as in a distinct, incontrovertible and correct fact cannot exist. Thus L.C. information is inherently subject to indeterminacy and relativism mostly reflected in its ontology.**
- **In the worst cases LULC information are treated as data by users who don't fully understand its inherent relativism.**
- **The consequences are a miss use of data bases information, a situation few users are prepared to acknowledge and even more difficult to document.**

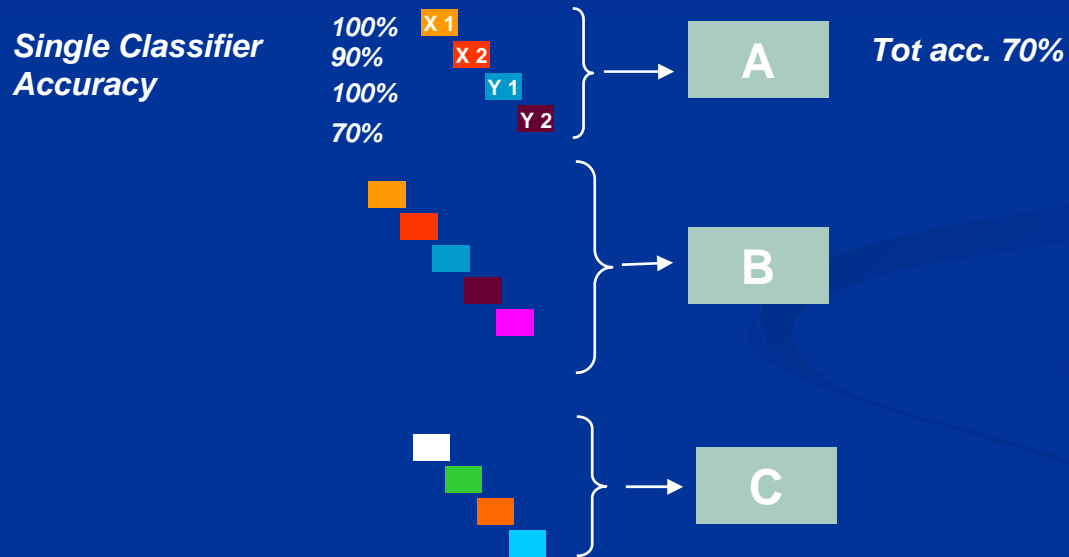
SEMANTIC PROBLEMS HAVE USUALLY A MUCH BIGGER IMPACT ON DATA UTILIZATION OF WHAT WE THINK

EXAMPLE: THE IMPACT OF SEMANTIC ON ACCURACY ASSESSMENT

Semantic problems affect accuracy in different ways:

- **Precise evaluation of errors hampered by the vagueness and ambiguity of names or definitions**
- **Difficulty to address new needs as:**
 1. **Level of error**
 2. **End user customization of the error**

ADVANTAGES OF THE USE OF PARAMETRIC APPROACH TO ADDRESS THE PROBLEMS OF THE LEVEL OF ERROR AND END USER ERROR CUSTOMIZATION



Overview of classification systems:

The EarthSat GeoCover L.C. Global Land Cover Legend

		Land Cover Class Definition
	FOREST DECIDUOUS	Trees > 3m height, canopy closure > 35%
	FOREST EVERGREEN	As above. Includes both broadleaf and needleleaf species
	SHRUB/SCRUB	Woody vegetation < 3 m in height With at least 10% ground cover
	GRASSLAND	Upland herbaceous grasses > 10% ground cover
5	BARREN	< 10% ground cover by other LC classes
6	URBAN/BUILT-UP	Includes residential, commercial and industrial, transportation, sport facilities
7	AGRICULTURAL LAND GENERAL	Cultivated and pasture land, except paddy agriculture
8	RICE/PADDY FIELDS	Irrigated or rainfed
	WETLAND, HERBACEOUS	Water table near the surface for most of the growing season. Includes playas and salt
10	WETLAND, MANGROVES	Sheltered coastal (estuarine) tropical wetlands supporting woody species of mangroves
11	WATER BODIES	Permanent open water bodies
12	PERMANENT ICE OR SNOW	Includes glaciers and permanent snow fields on mountains
13	CLOUDS/CLOUD SHADOWS/ NO DATA	Areas where land cover interpretation was not possible

FOREST DECIDUOUS

■ Woody vegetation > 3 meters (10 ft) in height that lose leaves periodically due to changing seasons or drought. Canopy closure must be >35% (<35% = Category 3). Also included in this category are areas commonly referenced as “swamp” or forested wetland if dominated by a deciduous canopy.

SCRUB

Woody vegetation less than 3 meters (10 ft) in height, with both closed and open canopies. Minimum ground cover is 10%; conversion to forest occurs at 35% canopy coverage provided the trees are > 3 m in height.

Inconsistency on definitions

- **Gap between classes FOREST vs. SCRUB**
- **Overlap between classes GRASSLAND vs. HERB. WET.**

GRASSLAND

Category may include herbaceous wetlands if images are collected during dry season or periods of drought. Land cover types commonly referenced as savanna and open savanna are included in this category.

A NEW PROSPECTIVE TO CLASSIFY LC:

- A classification process deals with the structuring of a specific knowledge domain in order to create consistency and stability in communication between users.*
- Classification is however a dynamic process definitions can change over time and prevalence of other cultures*
- It should be recognized that no classification system can reflect either the social or the natural world fully accurately*
- There are and it will be always multiple ways to conceptualize and communicate knowledge thus inherent ambiguity in any categorization*

THE CHALLENGE OF THE FORMALIZATION OF MEANING

It is imperative today that any new proposed classification systems be able to compliant to two major aspects:

- Move away from the vagueness of the human language***
- Be able to formalize the structure of the classification and its rules in a rigorous way to be shared and understood by a large user community***

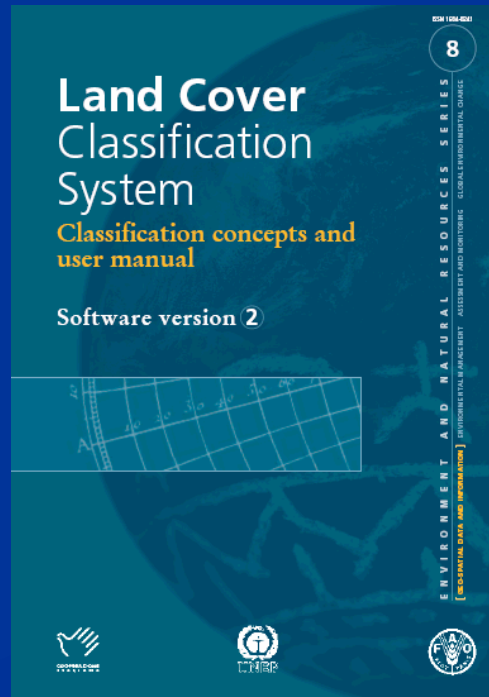
Any classification type should be documented/described as a formal language through a rigorous definition in terms of a generative grammar and its formal semantics.

LCCS has gone through this process generating a rigorous, fully documented comprehensive language to characterize L. C. features

THE LAND COVER CLASSIFICATION SYSTEM

LCCS

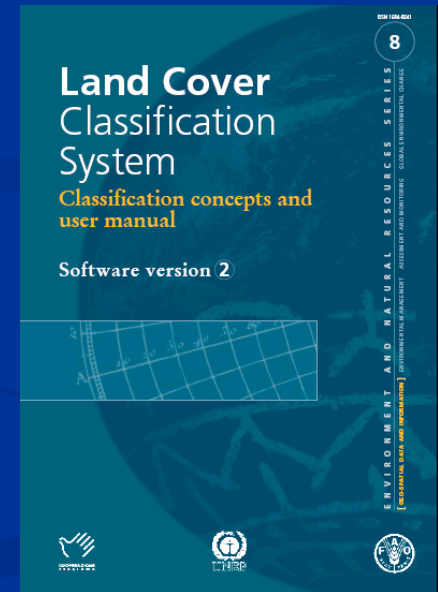
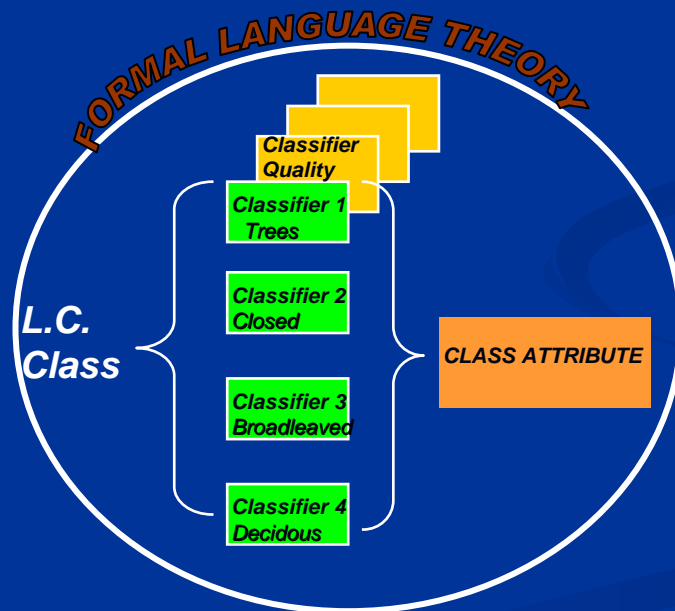
A NEW WAY TO APPROACH THE PROBLEM



THE BASIC CONCEPT

In LCCS the creation of a class is done by a dynamic combination of land cover diagnostic attributed called classifiers

The classifiers act as building blocks and can be combined to describe the more complex semantics of each land cover class in any separate application ontology (classification or legend)



MAIN REASONS TO DEVELOP A NEW LCCS vs 3

First concept of LCCS developed more than 10 year ago same updates were necessary both from technical and conceptual point of view:

- *Use of a predefined data base (dbase) from which to generate the L.C. classes.*
- *Use of tree structure for main land cover groups (dichotomous phase)*
- *Use of the element “artificiality” at an higher level of the classification*
- *Artificial limits in the definition of layers*
- *Sometimes still use of complex definitions*
- *Limits in the characterization of “time related” L.C. situations*
- *Not fully rigorous separation of pure phisiomomic/structural atomic elements from other types of elements*
- *Limitations to describe some “extreme” L.C. situations*
- *Use of a mathematical language to formalize the meaning.*

FROM LCCS to LCML (Land Cover Meta Language)

The formalization of a broad L.C. Language implies that some rules present in LCCS were inappropriate (too specific).

From the concept of LCCS a broader Land Cover Meta Language (LCML) has been created.

LCML represent a picture of the classification model with limited constrains between different elements forming a land cover class.

LCML is the base to generate different classification processes. LCCS vs 3 is one of them.

LCML has been represented in a UML (Unified Modeling Language)

FROM UML to XML

UML diagram is a visual representation of a series of rules and language structure.

UML has several advantages:

- easy to read and understand in non technical context*
- is object oriented structure is a basis for implementation in programming languages like JAVA or C ++*

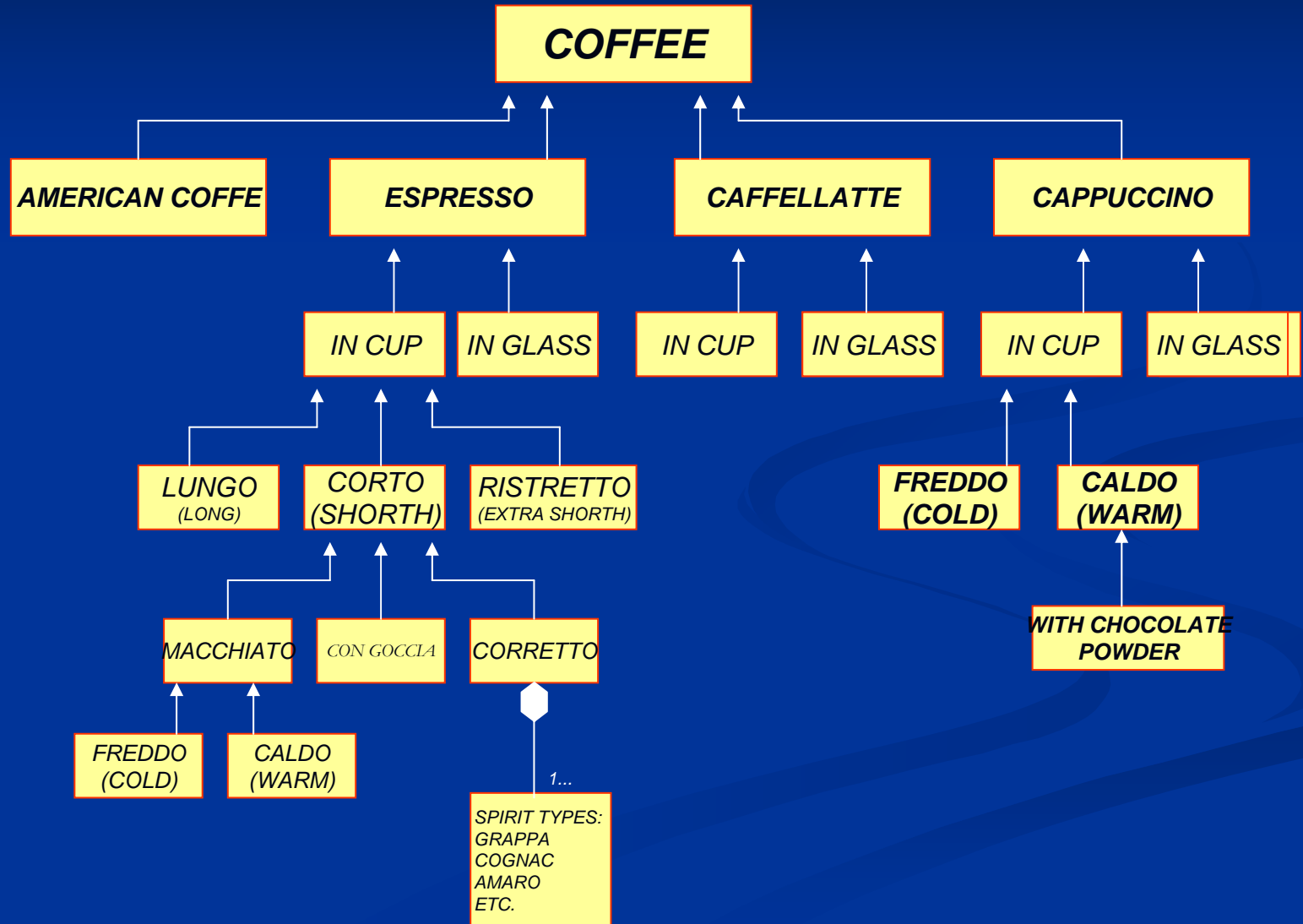
In order to use the LCML as a reference for the implementation of L.C. Classification software's implies a last passage the translation of the UML concept model to a computer oriented format.

The XML schema has been chosen because is:

- world wide diffusion*
- soundness in documentation resources, development and support*

**SEMANTIC PROBLEMS ARE CONSTANT PART
OF THE HUMAN SOCIAL RELATIONS**





MAJOR CHARACTERISTICS OF LCML (LCCS v3)

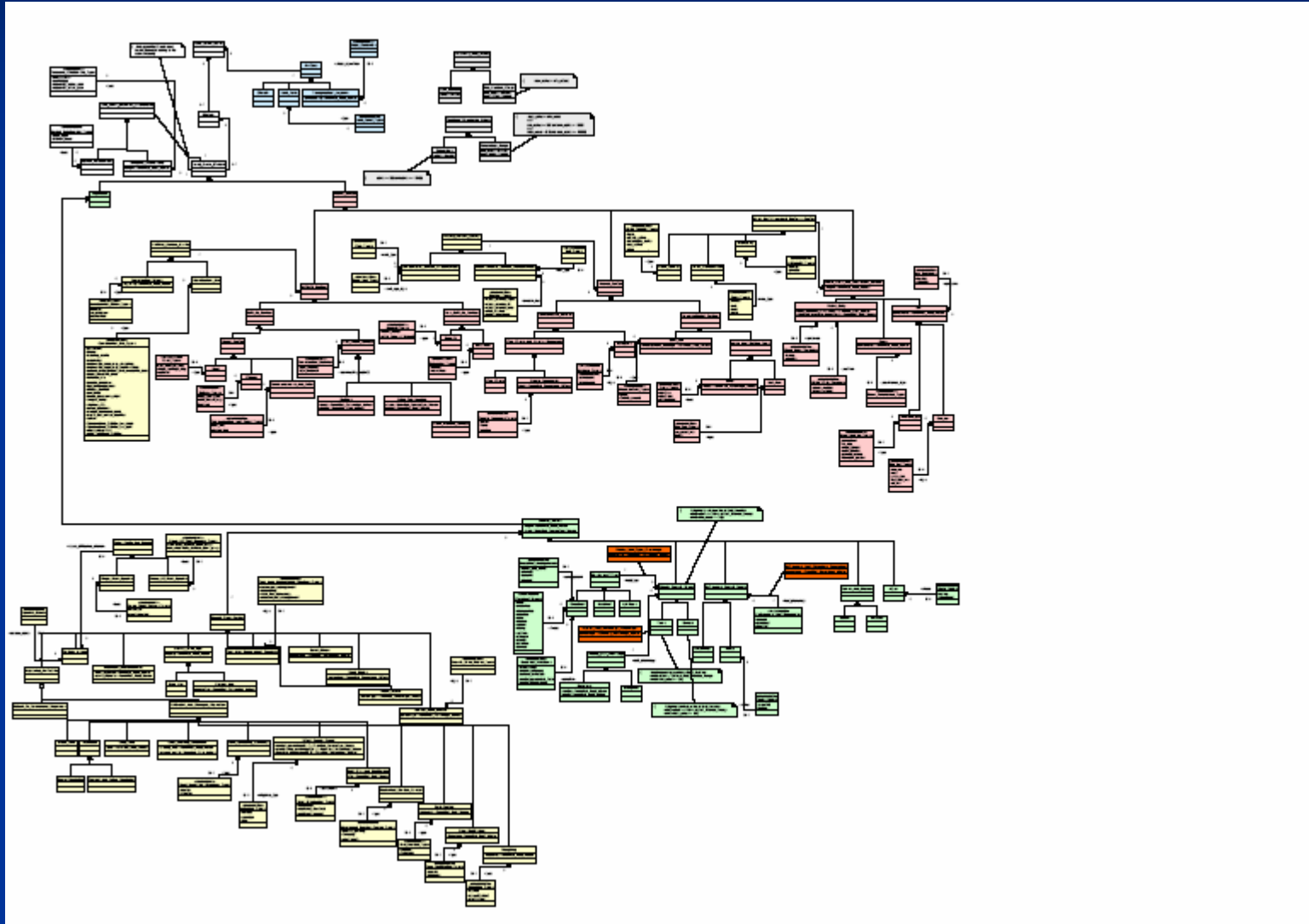
Simple classification criteria

Fundamental idea: a predefined set of basic elements (BIOTIC and ABIOTIC) enriched in their semantic significance with external qualities and attributes can be arranged in different types of strata to describe a wide variety of distinctive and detailed land cover situations

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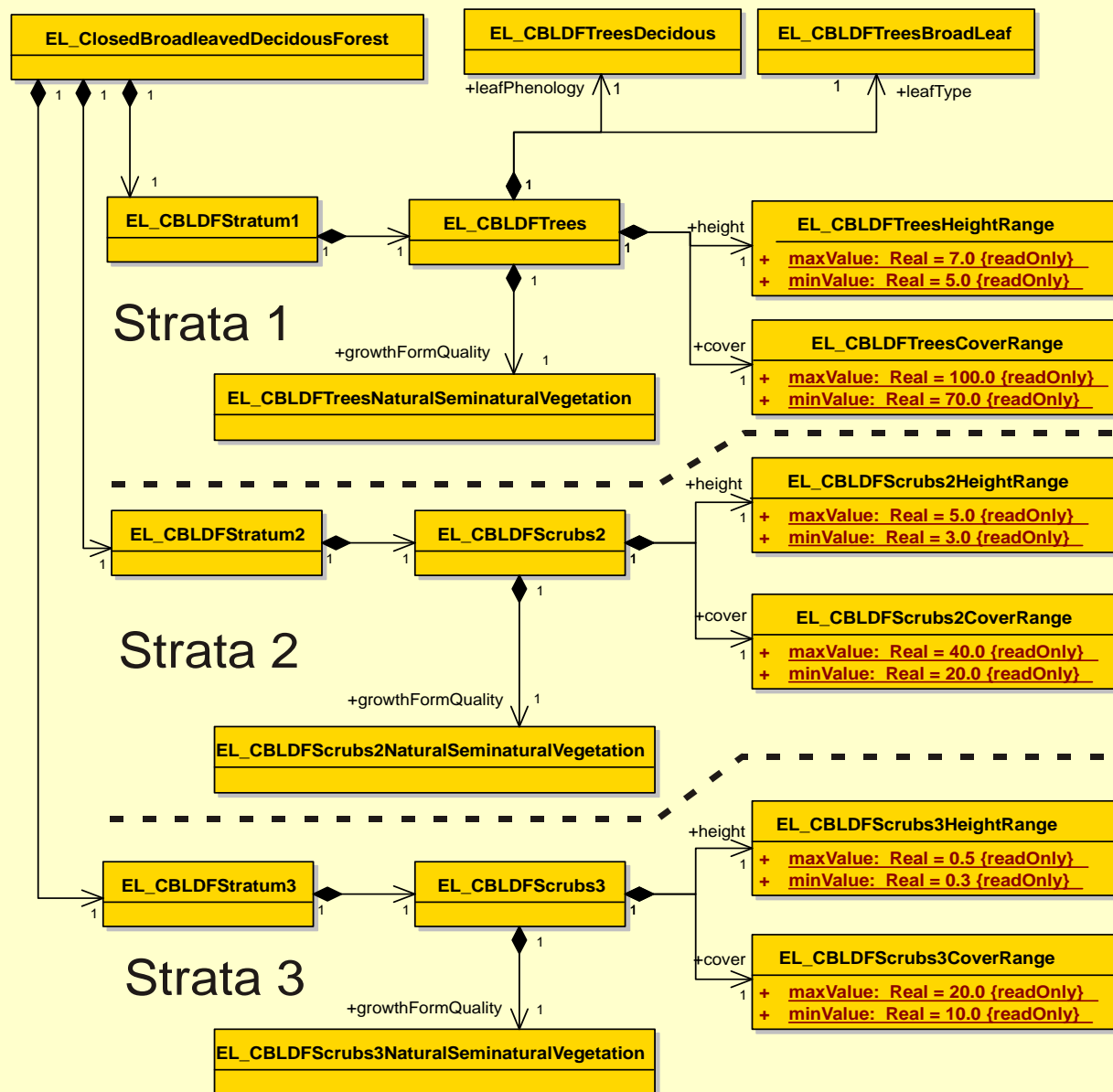
Beijing July 02, 2008

LCCS V.3



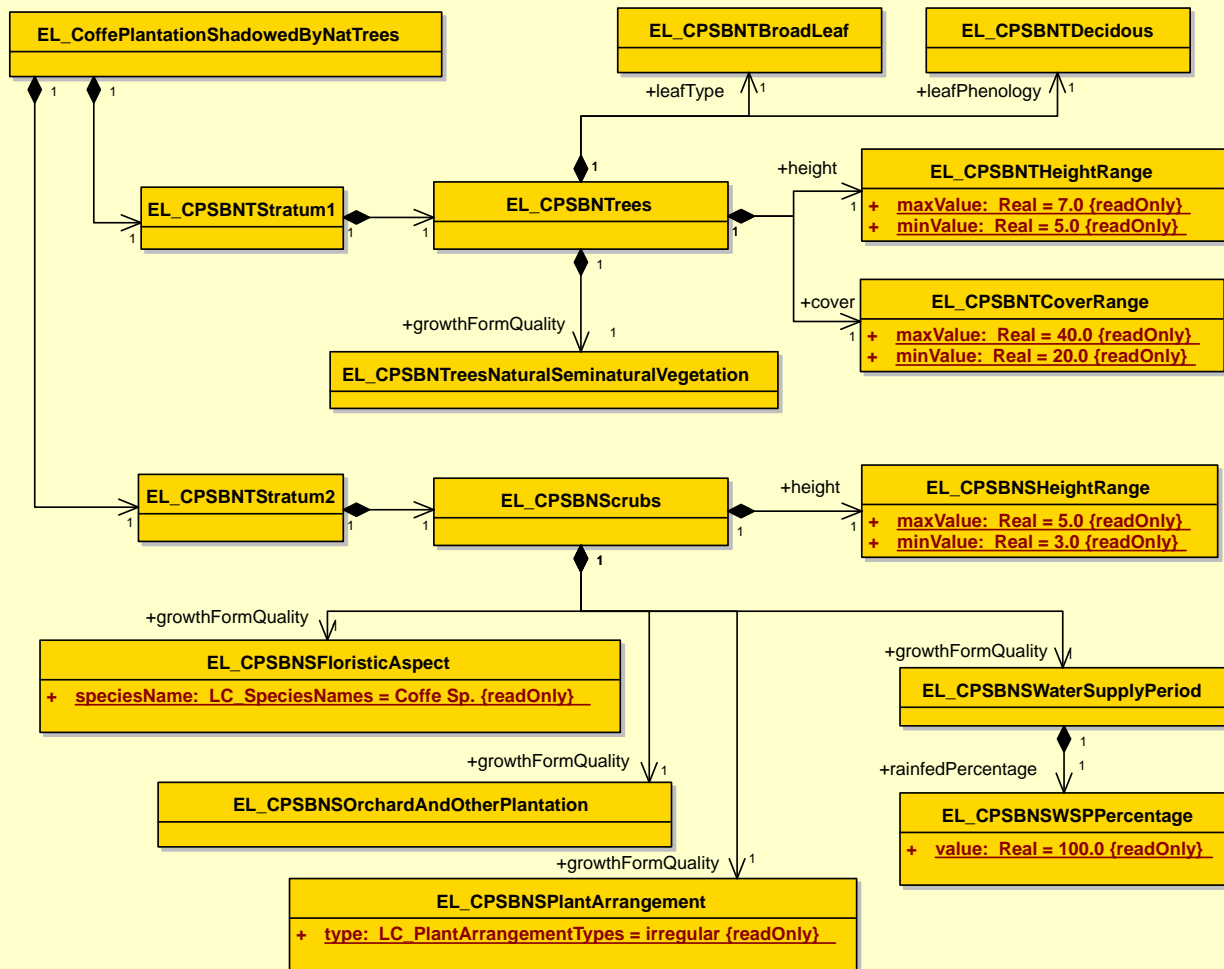
EXAMPLE 1: VEGETATION LAYERING

Broadleaved deciduous trees with two strata of scrubs



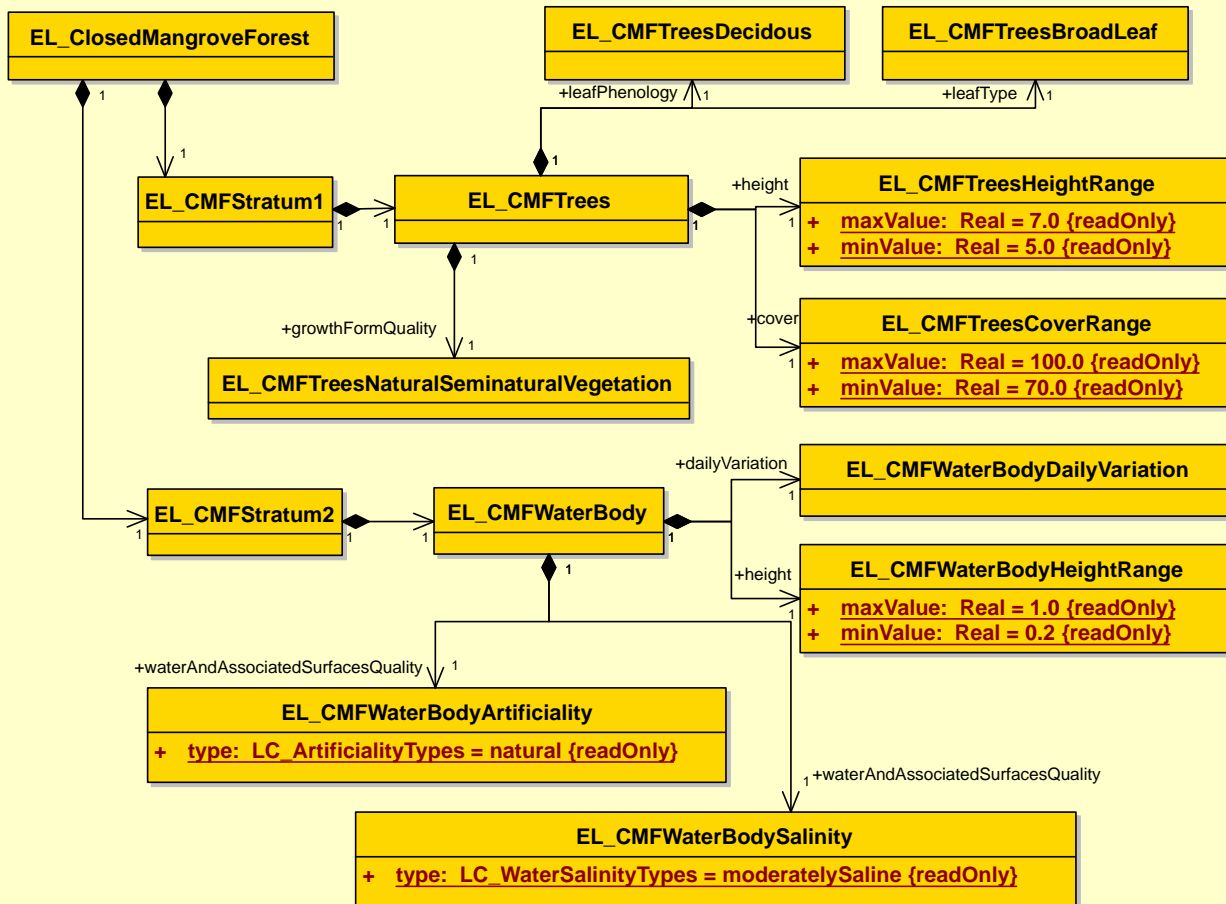
EXAMPLE 2: NATURAL AND MANAGED VEGETATION

Coffee plantation shadowed by natural trees



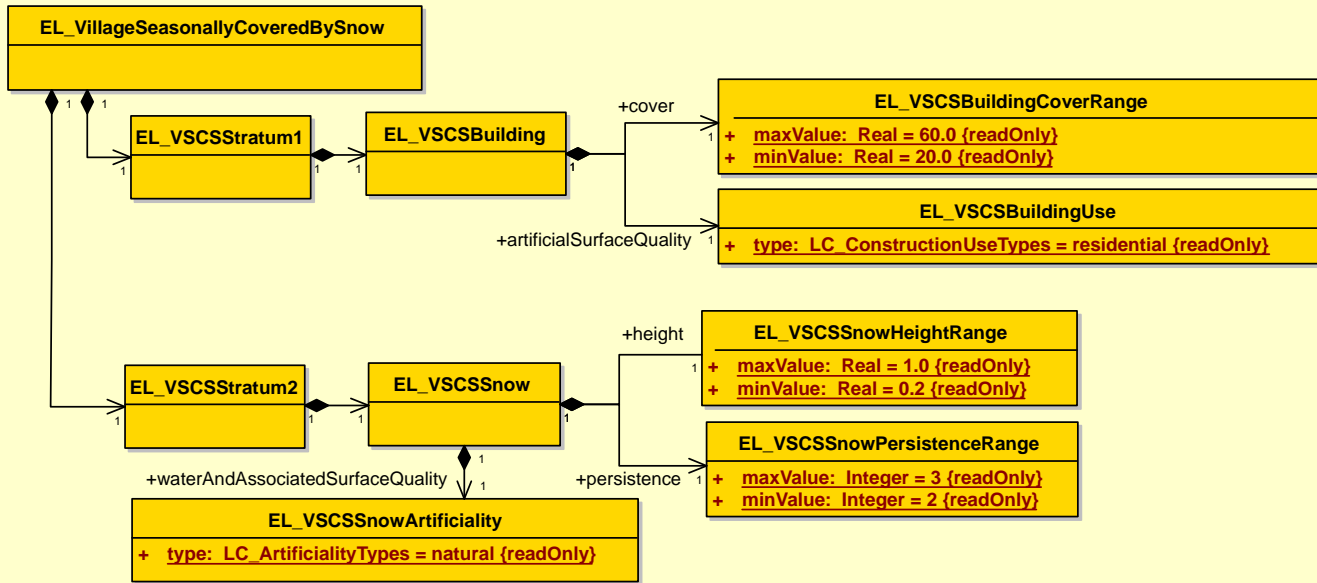
EXAMPLE 3: EDAPHIC AND ENVIRONMENTAL CONDITIONS

Closed mangroves trees



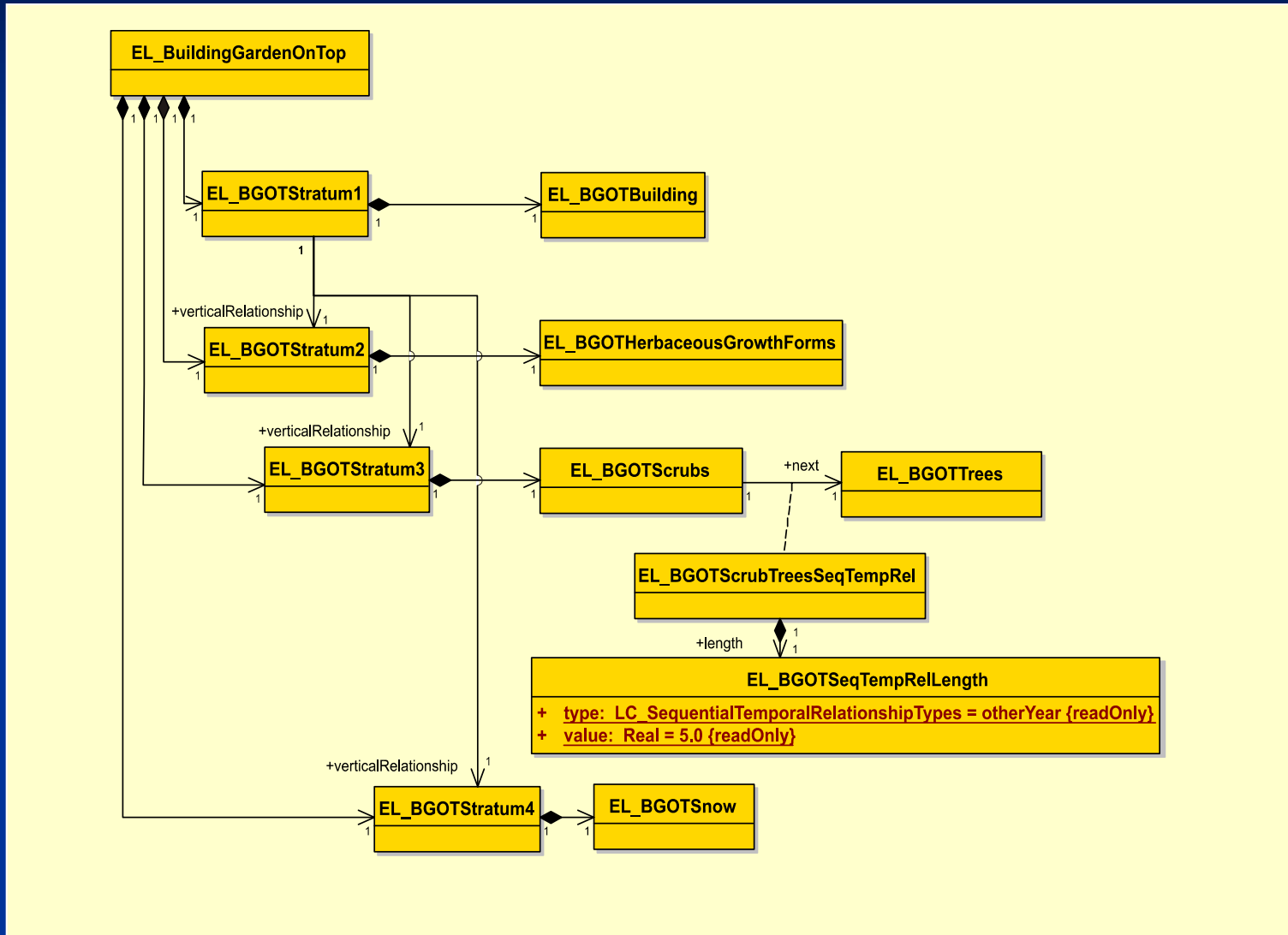
EXAMPLE 4: SEASONAL EVENTS

Village seasonally covered by snow

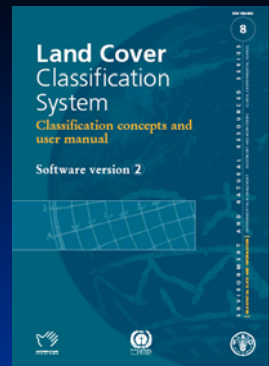


EXAMPLE 5: COMPLEX BIOTIC AND ABIOTIC RELATIONSHIP

Building with garden on top with young trees seasonally covered by snow



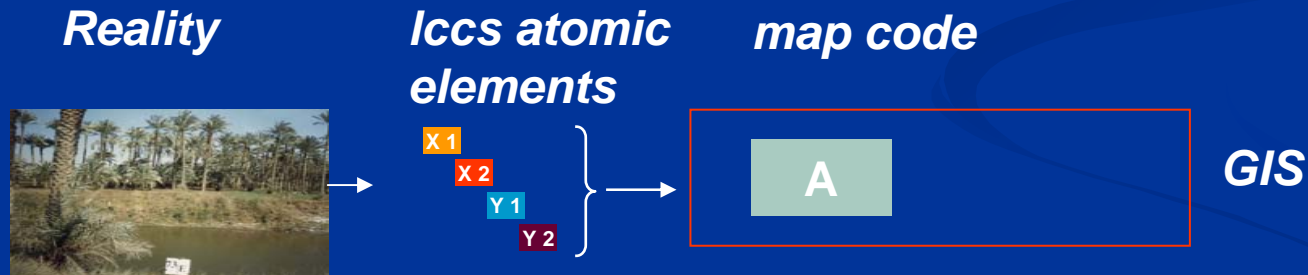
THE NEW LCCS vs 3



LCCS vs 3 derived from LCML

UML → XML + extra rules = LCCS vs 3
OPEN PROBLEMS:

- *programming language JAVA or C++*
- *relationship LCCS 3 and GIS to be debate (actually GIS not able to deal with the granularity of LCCS information*



SOLUTIONS:

- **LCCS GIS PLUG IN**
- **ADG**

THE END