



Instituto de Ingeniería del
Agua y Medio Ambiente



UNIVERSIDAD
POLITECNICA
DE VALENCIA

Riparian water and vegetation model for semiarid climatic conditions

By:

Marco Morales andy Félix Francés

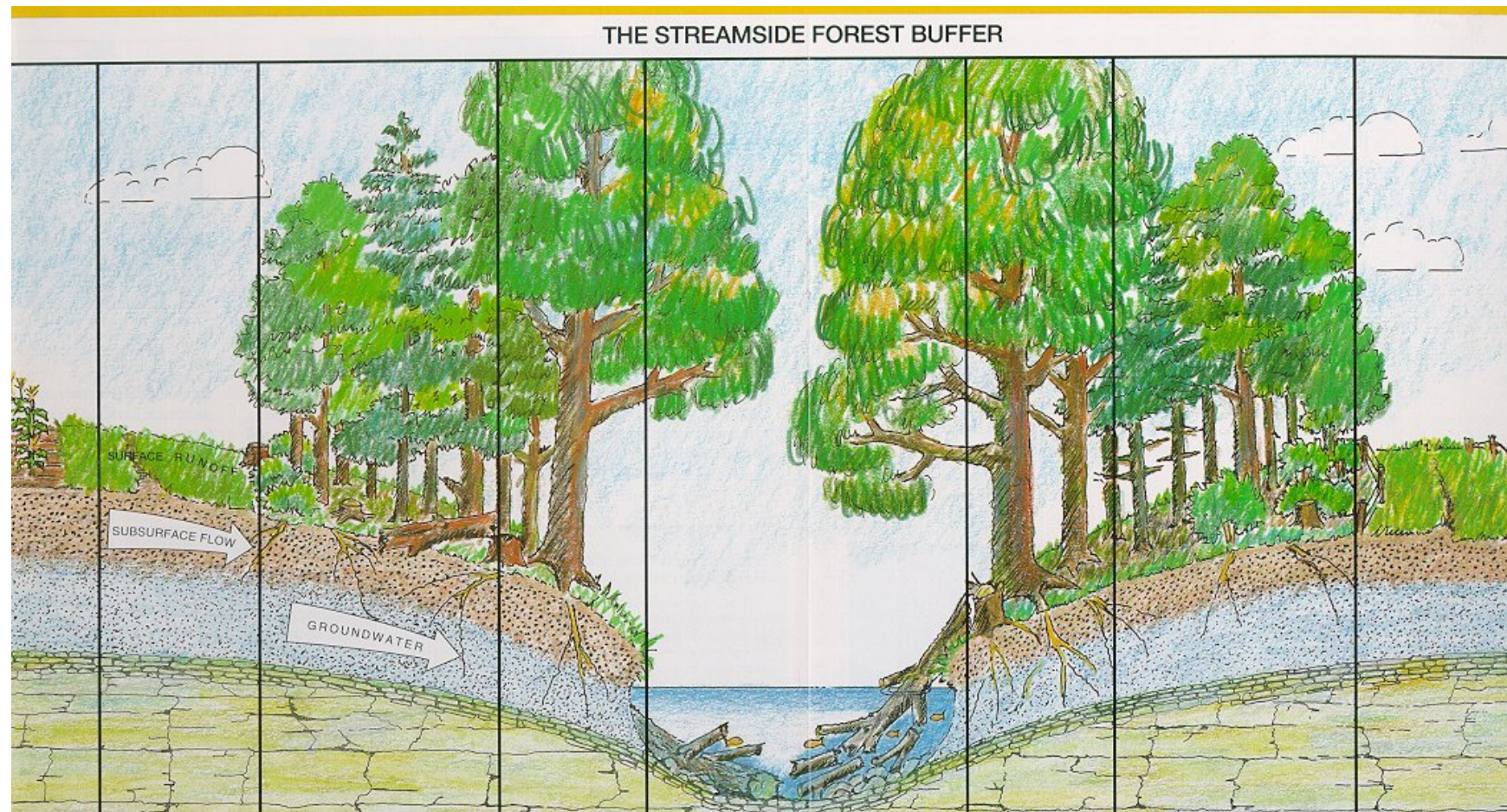
Universidad Politécnica de Valencia - España
Instituto de Ingeniería del Agua y Medio Ambiente
Grupo de Investigación de Hidráulica e Hidrología

<http://lluvia.dihma.upv.es>



RIPFLOW PROJECT: Lisboa kickoff meeting 11/12/08

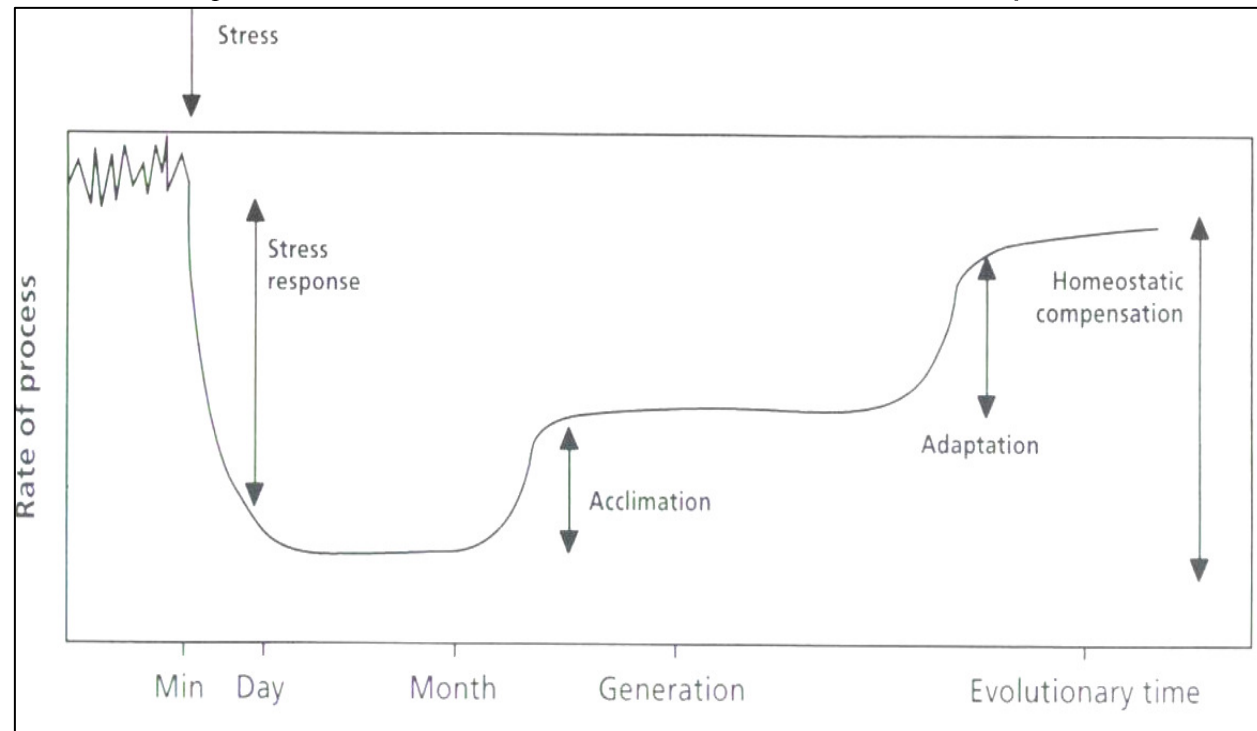
Riparian zonation



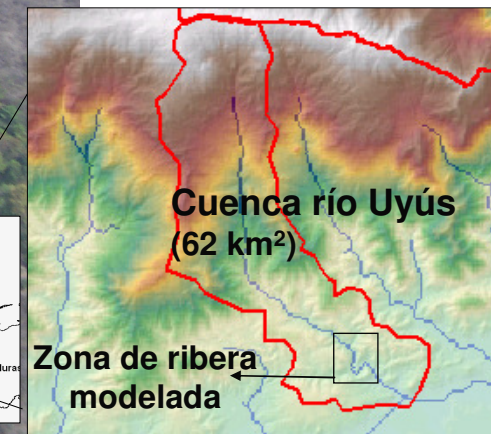
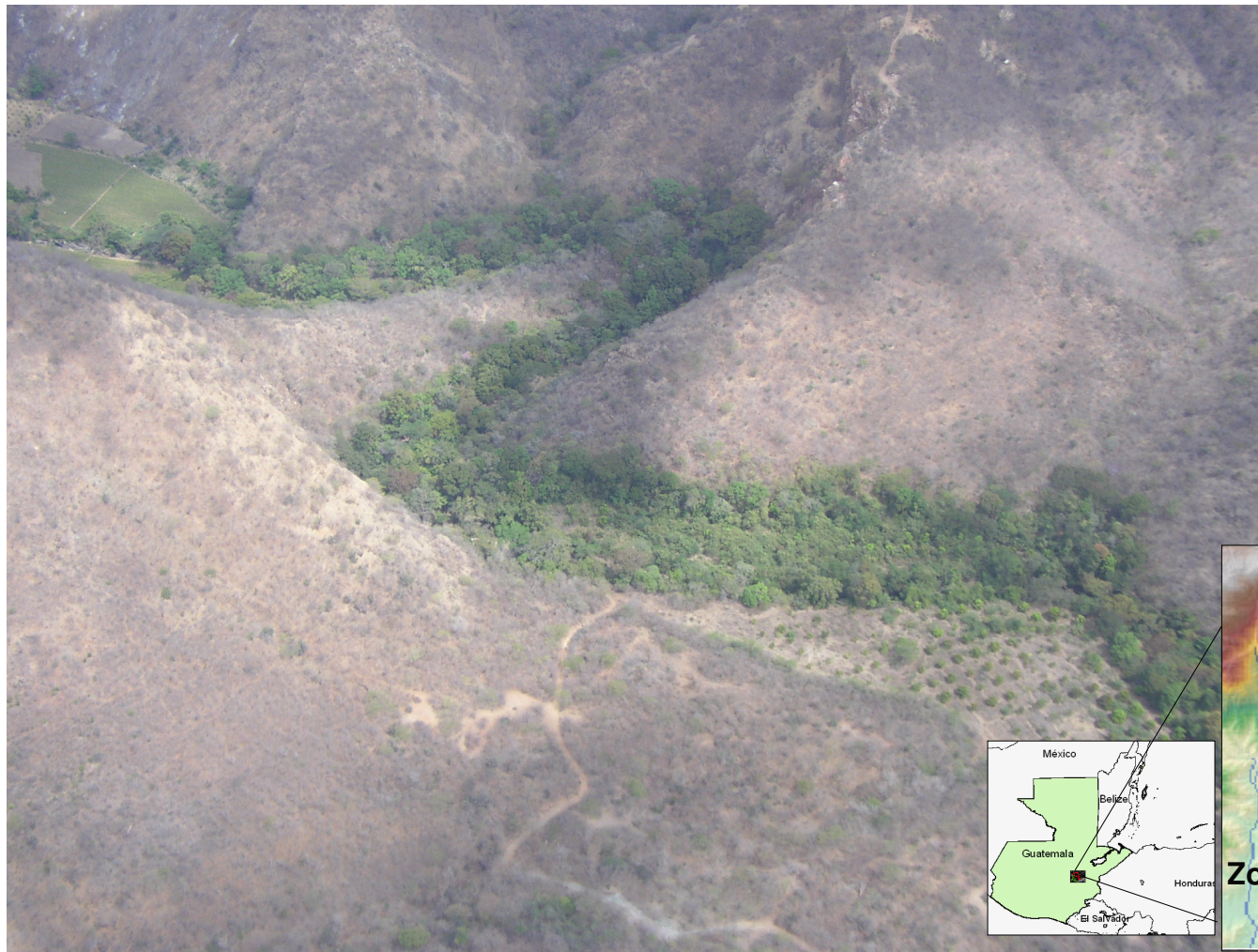
REMM (Lowrance, 1998); RIP-ET (Baird & Maddock, 2005)

Dynamic riparian vegetation

- There is an interaction between river and riparian zone (Bren, 1993; Brookes et al 2000; Hughes et al, 2003; Richards et al, 1996 y 2002; Tabacchi et al, 2000)



Sierra de las Minas (Guatemala)



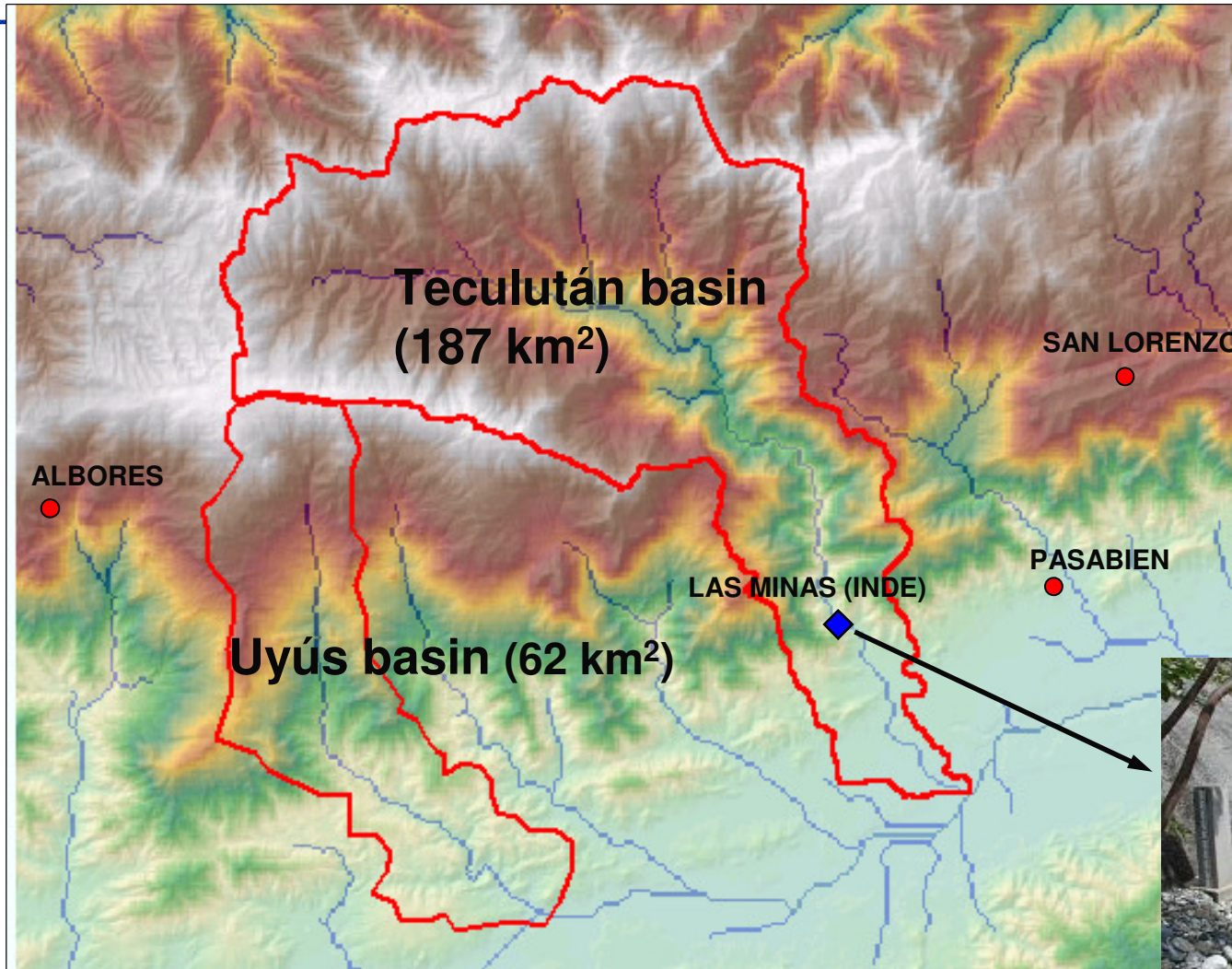
Study Site: Sierra de las Minas

- Upper part of the basins:
 - Above 2,000 m.a.s.l.
 - Cloud forest
 - > 2,500 mm/year
 - ~ 600 mm/year horizontal precipitation

- Lower part of the basins:
 - Dry forest
 - < 900 mm/year

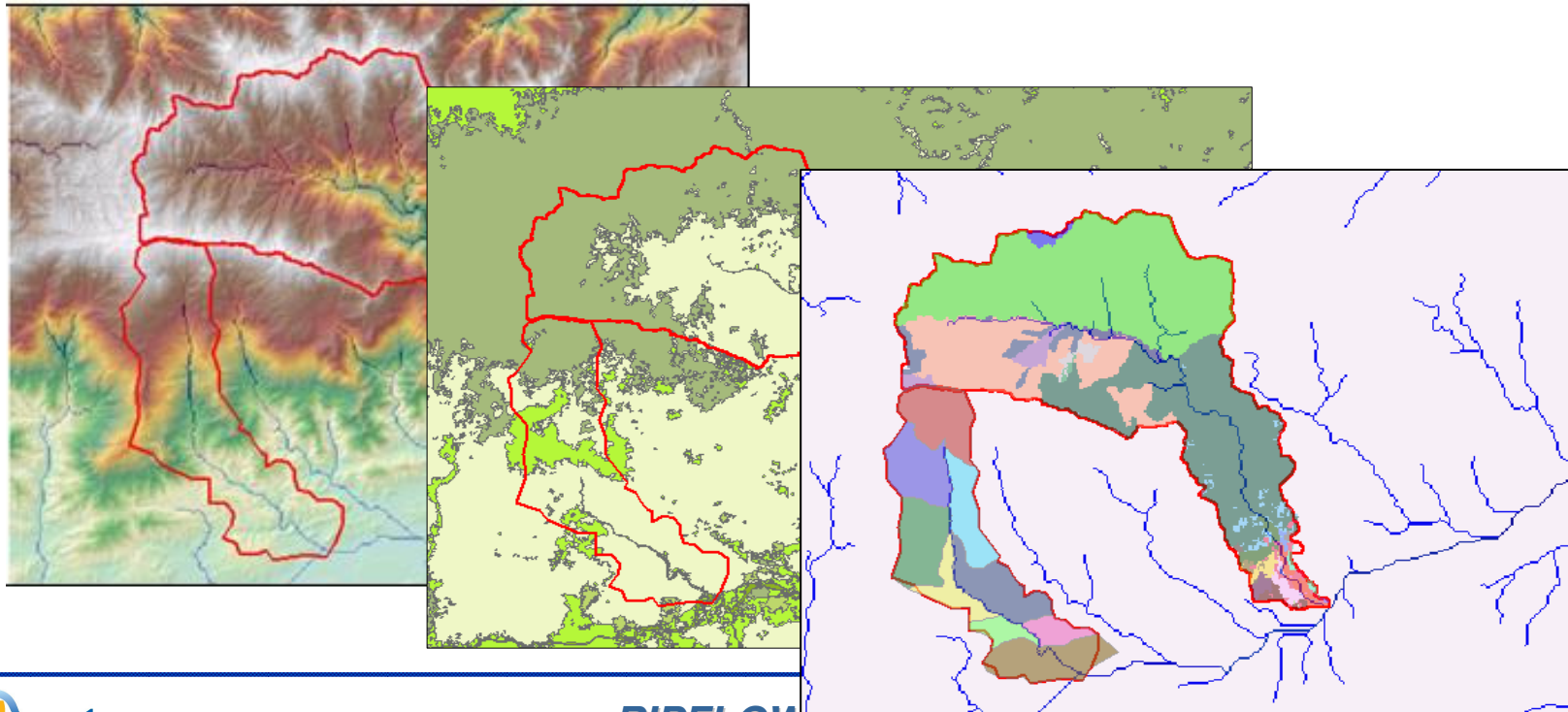


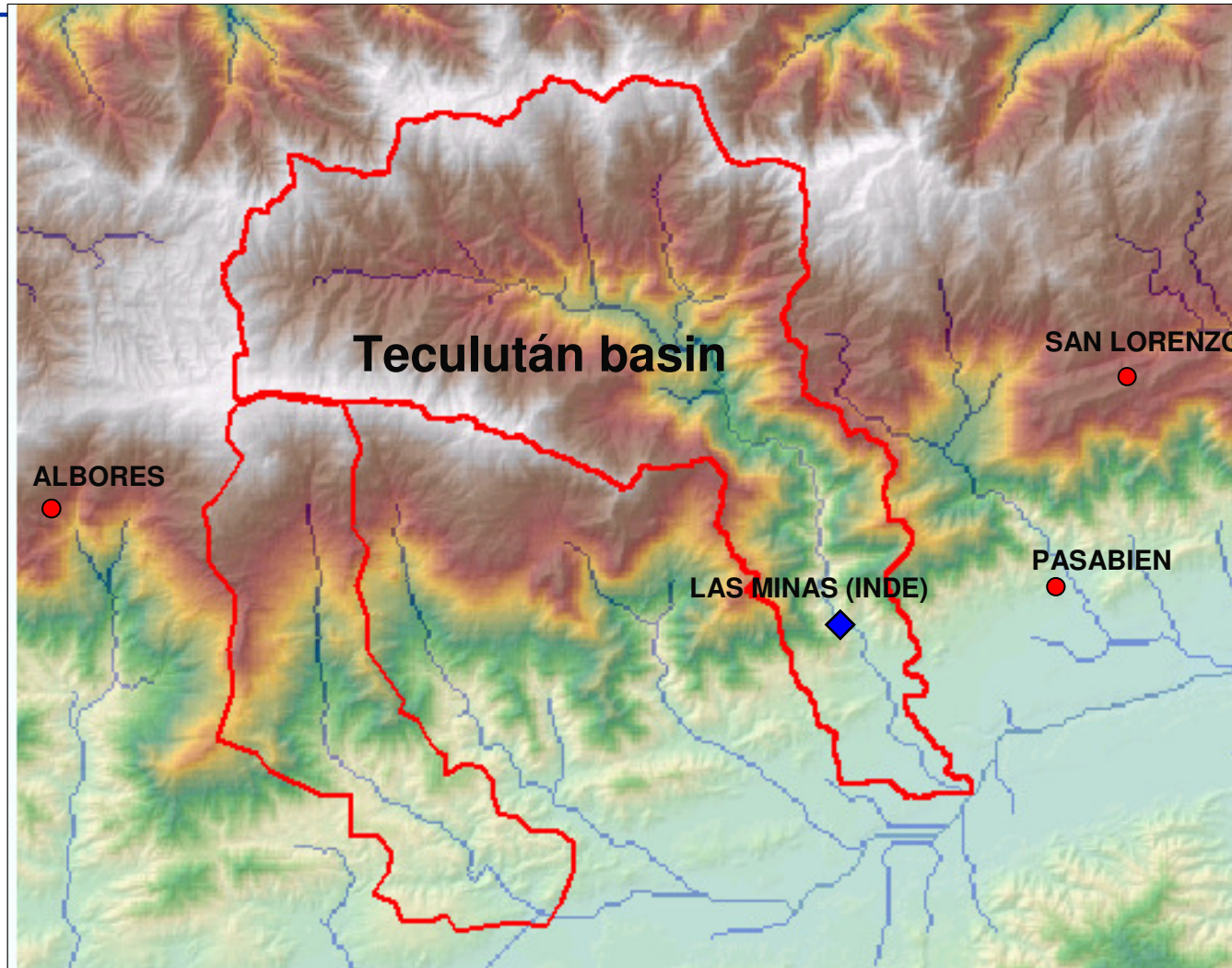
Study Site: Sierra de las Minas



Spatial information

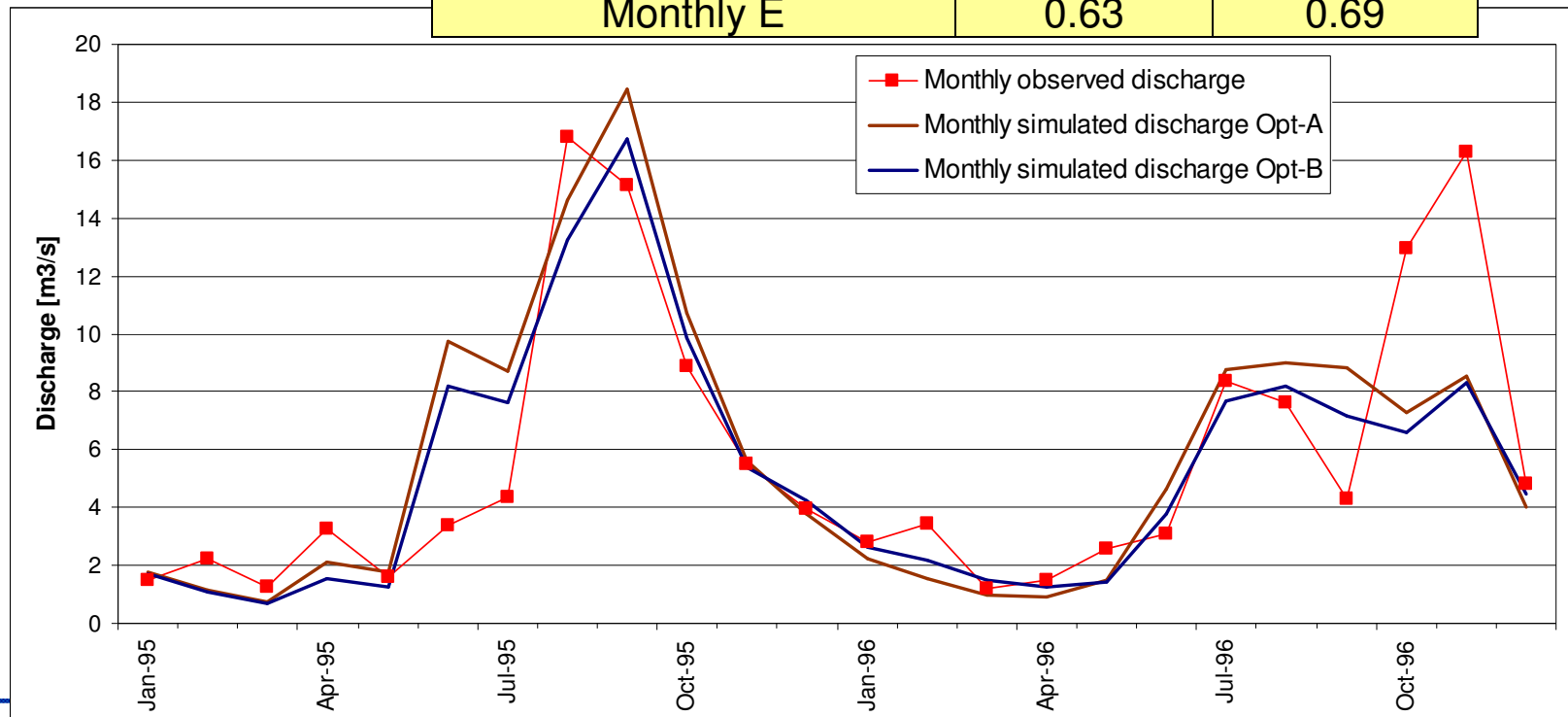
- Originally 20 m DEM: model reduced to 100 m cell size
- Complete Vegetation Cover map at 1:50.000
- Partial coverage of Geology and Soil maps at 1:50.000



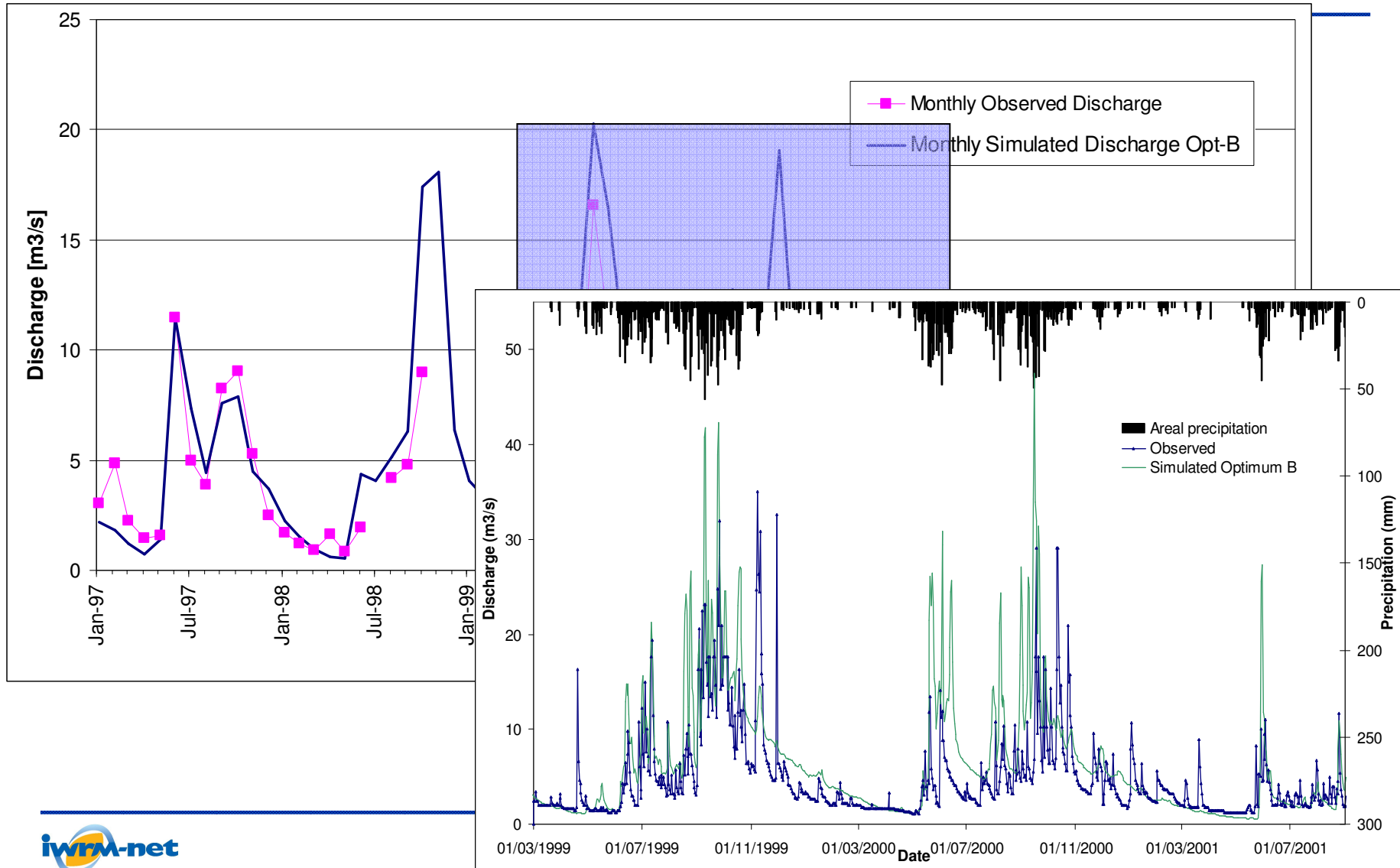


- Model: Tetis v.7.0 (Vélez, 2001; Francés et al, 2007)

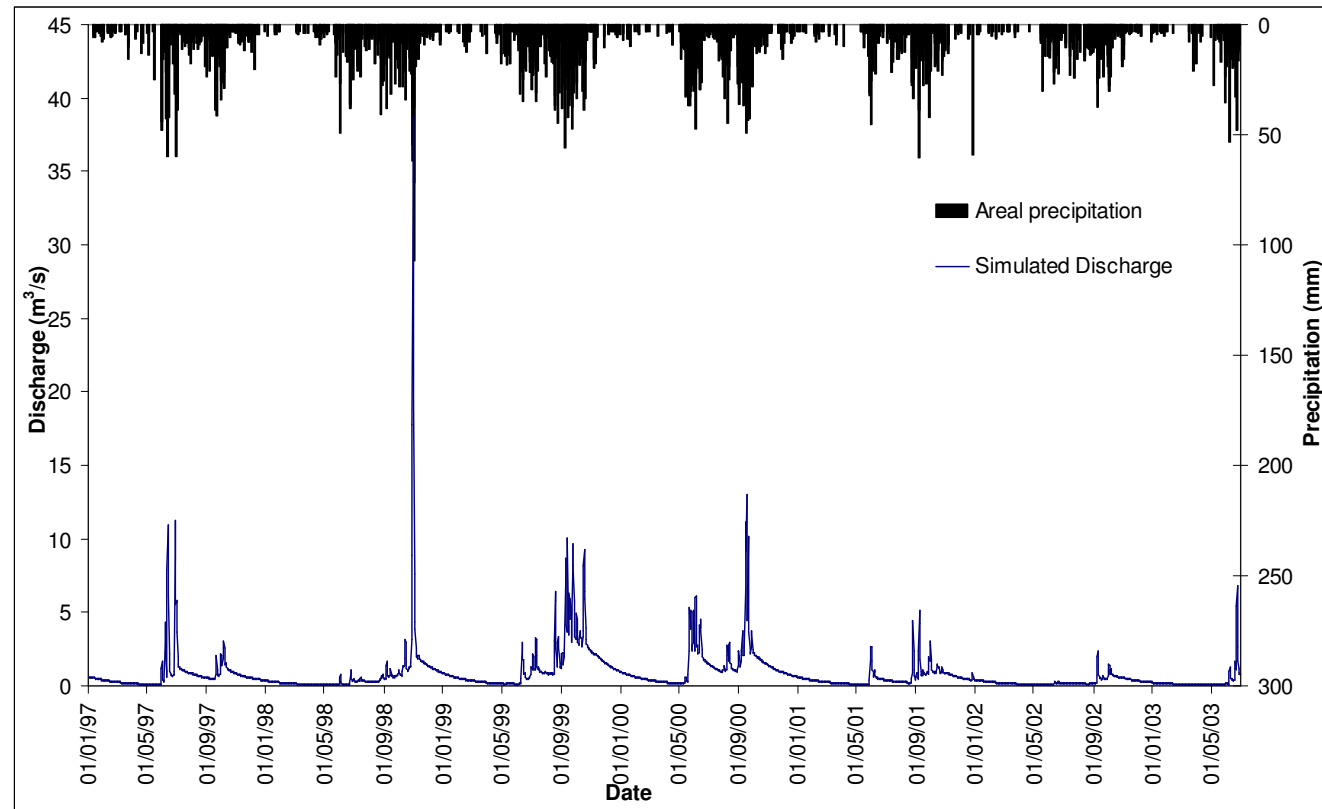
Performance indexes	Optimum A	Optimum B
RMSE	7.28	7.06
BE	4.4%	7.81%
daily E	0.12	0.17
Monthly E	0.63	0.69



Temporal validation at Teculután

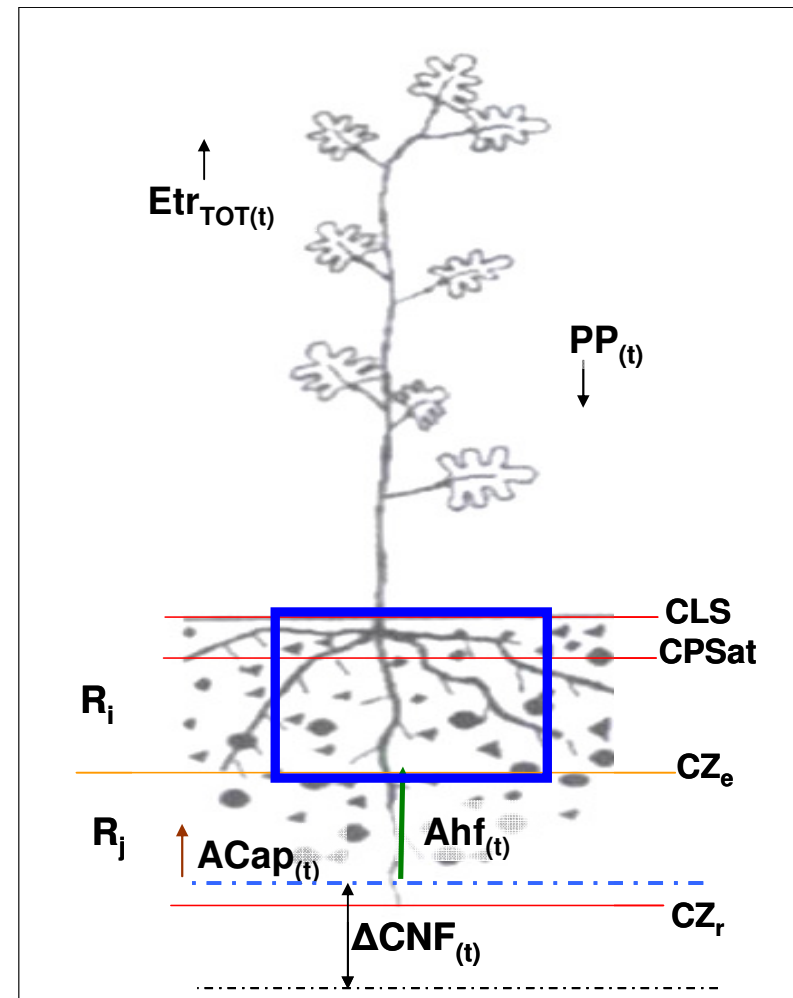


Reconstruction at Uyús

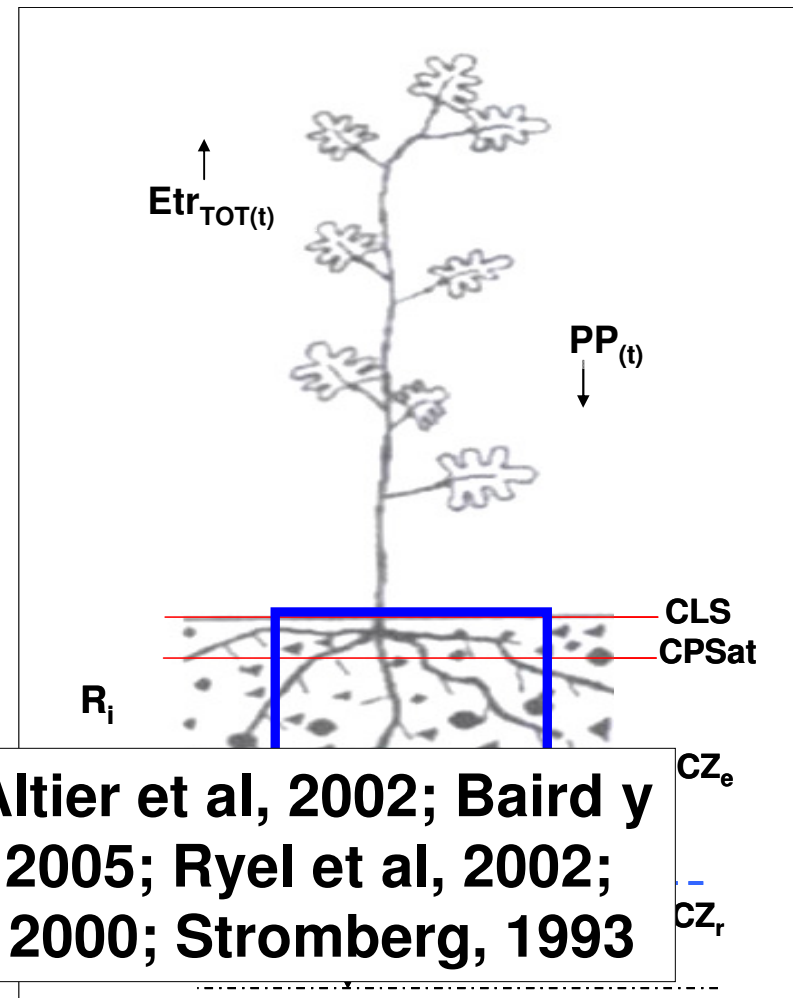


- Elements:
 - Vegetation
 - Static tank
 - Saturated zone

- Inputs (time series):
 - Precipitation
 - PET
 - River daily discharges

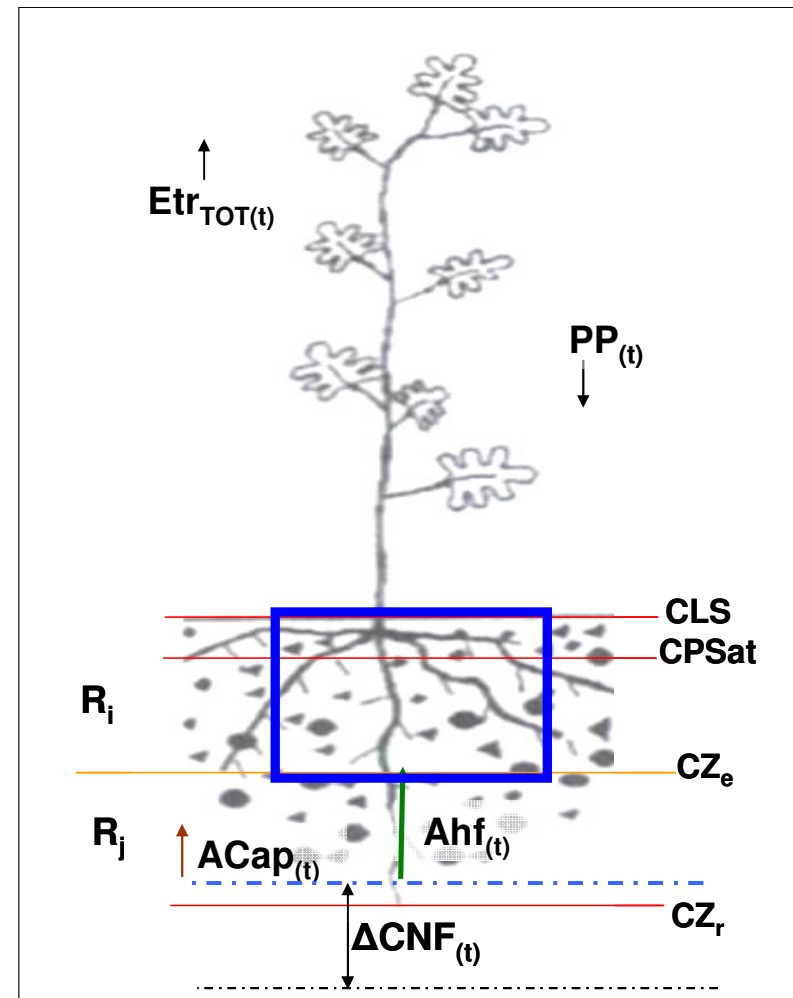


- Processes:
 - Runoff and percolation by excedent
 - Transpiration:
 - Saturated
 - Non saturated
 - Plant drowning
 - Soil capillary rise
 - Root hydraulic I

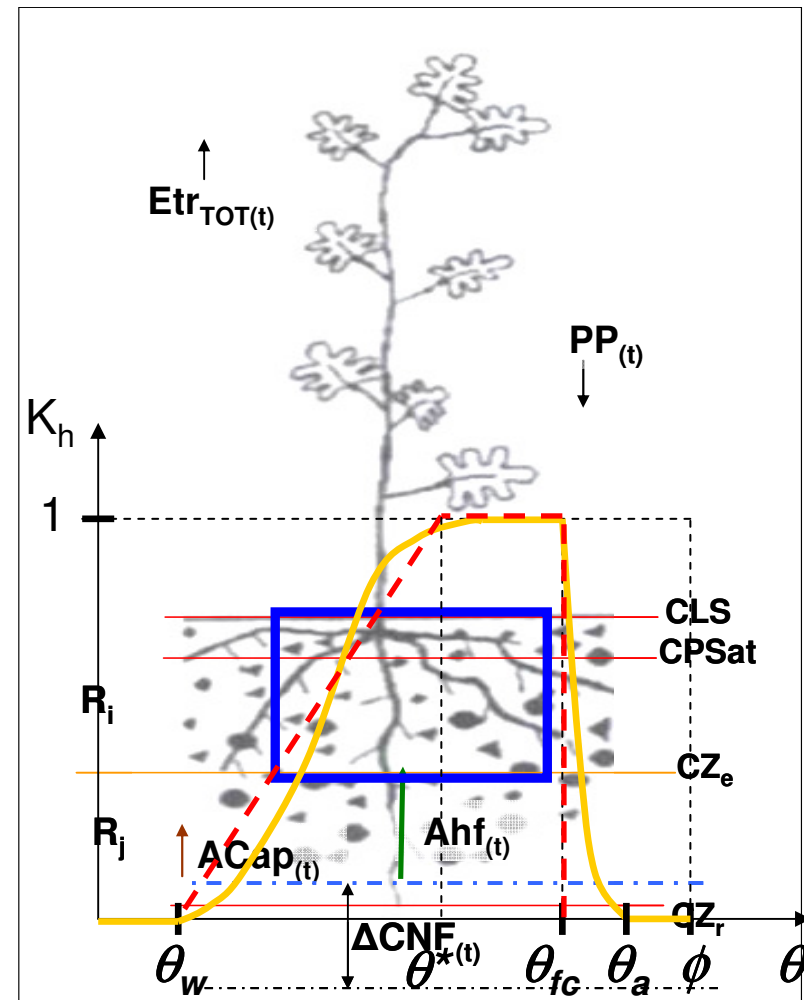


- Hydrometry characteristics:
 - Soil surface elevation
 - Flow rating curve

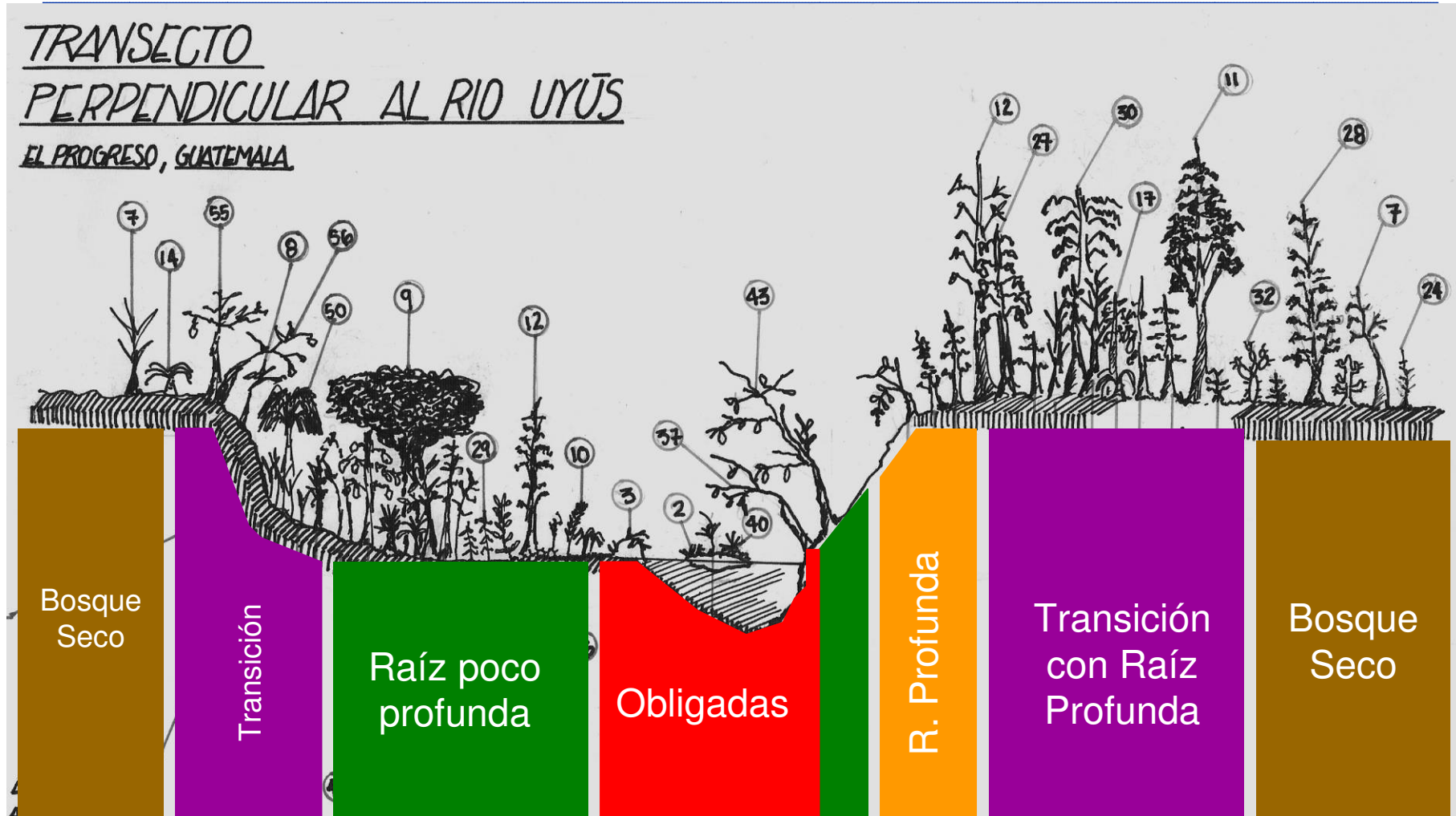
- Soil characteristics:
 - Field capacity
 - Retention curve
 - Non sat. permeability curve



- Vegetation characteristics:
 - Vegetation density
 - Maximum root depth
 - Effective root depth
 - Drowning depth (can be negative)
 - Transpiration preference
 - Root hydraulic lift capacity
 - Transpiration curve
 - Wilting point (water pot.)
 - Critical point (water pot.)



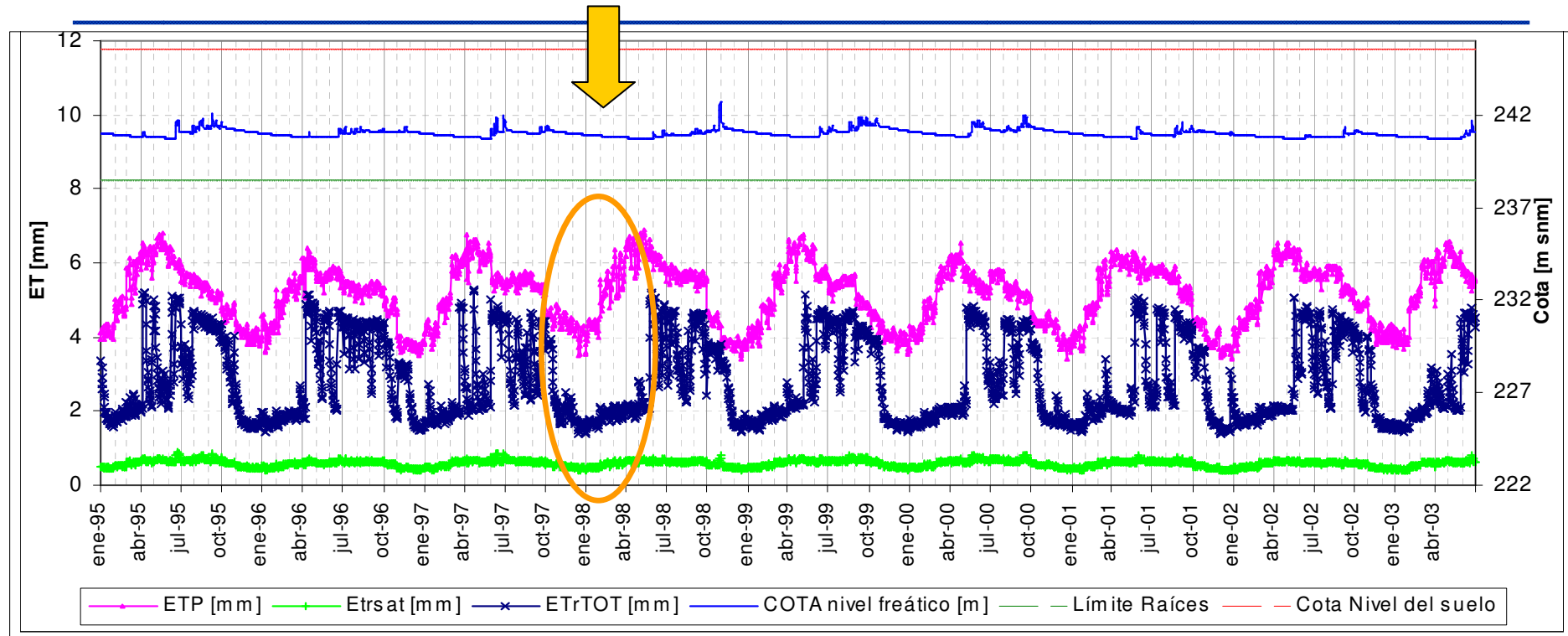
Functional vegetation types



Functional vegetation types

No.	Tipo funcional de vegetación	Clasificación según Baird y Maddock (2005) y Stromberg et al (1996)	Especies indicadoras y familia (basado en trabajo de campo Guatemala)
1	Herbácea Obligada de Ribera (H Ob)	Obligadas de humedal	<i>Lindenia rivalis</i> (Rubiaceae), <i>Typha dominguensis</i> (Typhaceae), <i>Heteranthera reniformis</i> (Pontederiaceae), <i>Spirodela polyrhiza</i> (Lemnaceae), <i>Hyptis verticillata</i> (Verbenaceae-hierba), <i>Sida sp.</i> (Malvaceae-hierba), <i>Paspalum sp.</i> , <i>Oplismenus sp.</i> , <i>Panicum sp.</i> (Poaceae).
2	Regeneración Raíz Poco Profunda - estadios juveniles hábito arbustivo- (Rnp)	Ribera raíz poco profunda / Facultativa de humedal	<i>Cyperus sp.</i> (Ciperaceae-hierba) . Como arbustos están: <i>Sabal guatemalensis</i> , <i>Balaoude sp.</i> (Araceae), <i>Piper aduceum</i> (Piperaceae), <i>Trichilia hirta</i> (Meliaceae). Aquí se incluyen los estadios primarios de sucesión de especies arbóreas de ribera.
3	Arbórea Obligada de Ribera (A Ob)	Ribera de raíz profunda / woody obligate wetland plants	<i>Inga vera</i> (Mimosaceae), <i>SN</i> (roble), <i>Andira inermis</i> (Fabaceae), <i>Ceiba pentandra</i> (Bombacaceae), <i>Enterolobium cyclocarpum</i> (Mimosaceae), <i>Nectandra sp.</i> (Lauraceae), <i>Spondias purpurea</i> (Anacardeaceae), <i>Cecropia peltata</i> (Cecropiaceae), <i>Simarouba glauca</i> (Simaroubaceae)
4	Arbórea Facultativa de Ribera (A Fc)	Ribera de transición o facultativas / woody facultative wetland plants	<i>Ceiba aescutifolia</i> (Bombacaceae), <i>Chlorophora tinctoria</i> , <i>Ficus sp.</i> (Moraceae), <i>Thouinidium decandrum</i> (Sapindaceae), <i>Pouteria sp.</i> , <i>Chrysophyllum mexicanum</i> (Sapotaceae), <i>Bursera simaruba</i> (Burseraceae),
5	Bosque Seco (Bsec)	No aplica	<i>Leucaena diversifolia</i> , <i>Acacia sp</i> (Mimosaceae), <i>Guaiacum sanctum</i> (Zygophyllaceae), <i>Jacquinia aurantiaca</i> (Theophrastaceae), <i>Cnidoscolus sp.</i> (Euphorbiaceae-arbusto), <i>Lippia graveolens</i> (Verbenaceae-arbusto). Típicas de Bosque seco encontradas en ribera: <i>Caesalpinia velutina</i> , <i>Caesalpinia pulcherima</i> , <i>Hymenaea courbaril</i> , <i>Haematoxylon brasiletto</i> (Caesalpinaceae), <i>Karwinskia calderoni</i> (Rhamnaceae)

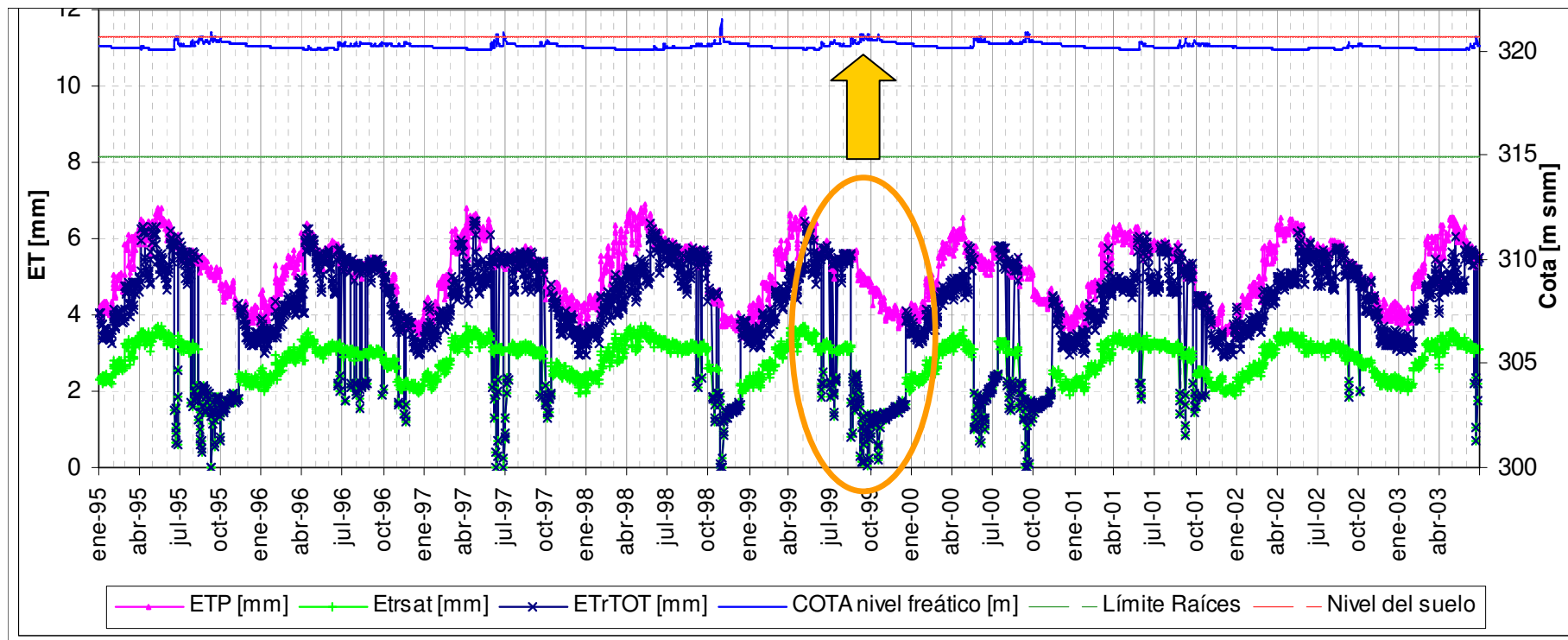
Results at Uyús



“Arbórea Facultativa” in transition zone.

- Mean ETr = 2.8 mm/day
- ETr = 2 mm/day in dry season. Root hydraulic lift more than 1 mm/day

Results at Uyús



“Arbórea Obligada” in low land

- Mean ETr = 4 [mm/day].
- ETr = 3.9 [mm/day] in dry season because saturated transpiration + root hydraulic lift about 1 mm/day

Conclusions

- The present RibAV model considers only:
 - River effects on the vegetation, not viceversa
 - Limitation factor: water availability
- Vegetation parameterization by functional types
- For each position, the predicted functional type is which has the maximum actual T.