CIRF - Centro Italiano per la Riqualificazione Fluviale

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RECUPERACION de RIOS y RIESGO HIDRAULICO

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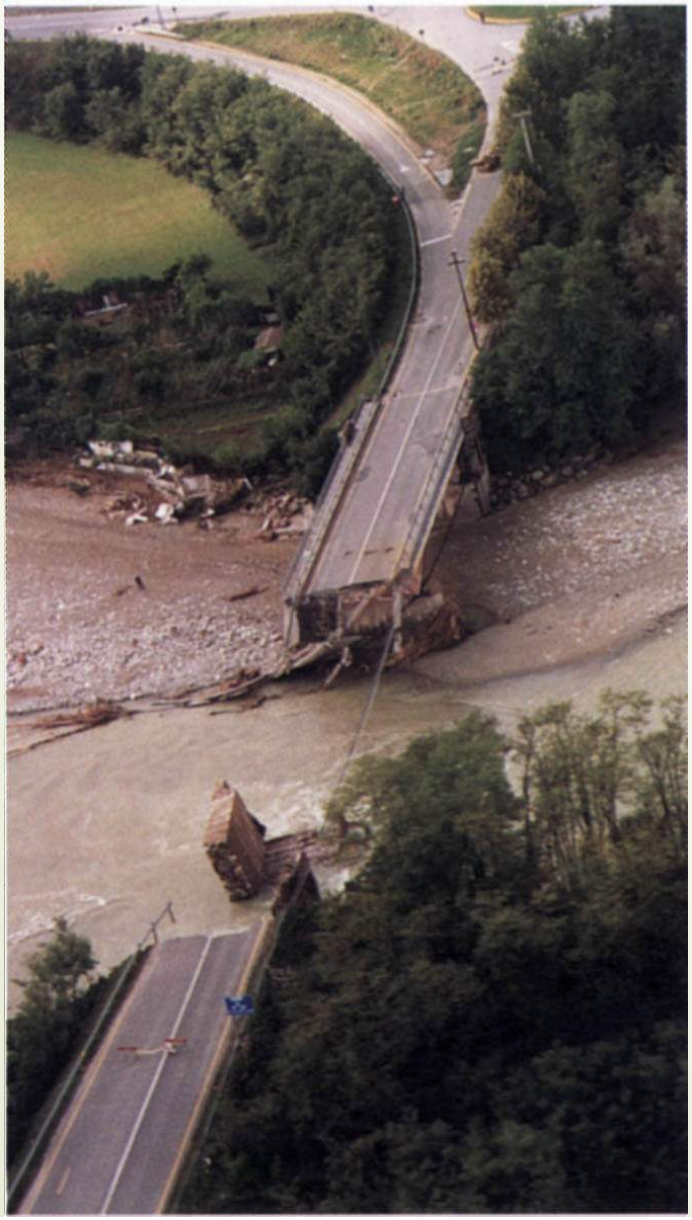
Hidro-morfologico

Centr
p
Riqualifica



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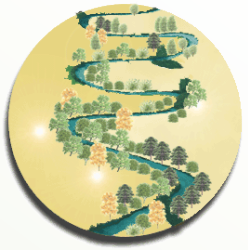
ENFOQUE HIDRAULICO "CLASICO"

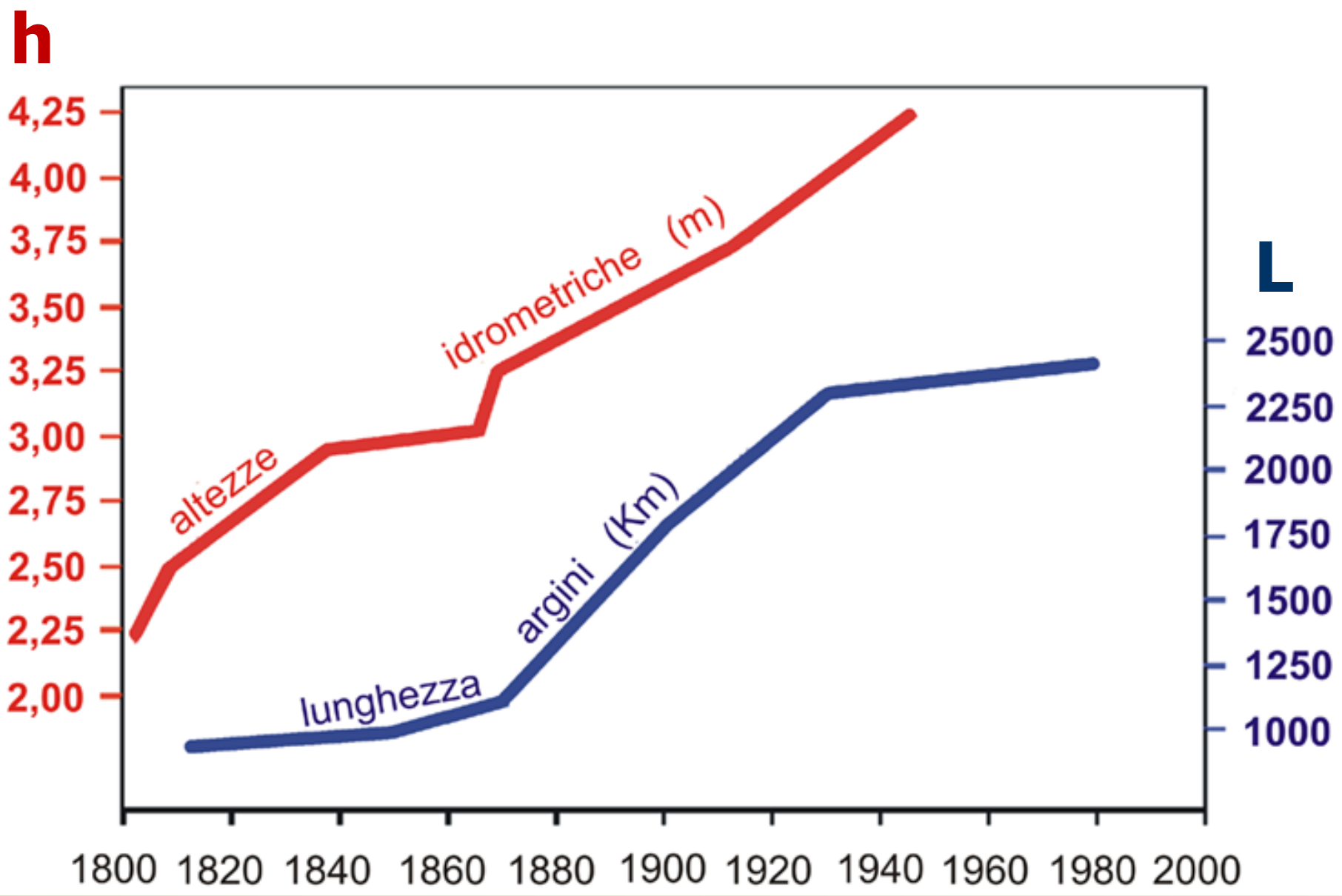


"poner en seguridad"

- **Deshacerse del agua lo antes posible → cauces eficientes, lisos, "limpios"; desviadores**
- **Contener el agua en el cauce separandolo del territorio → terraplenes**
- **Fijar el rio (y las montanas) → defensas de riberas, diques, …**

Efecto de las obras de defensa: el rio Po (Italia)

rio Po: terraplenes y efectos



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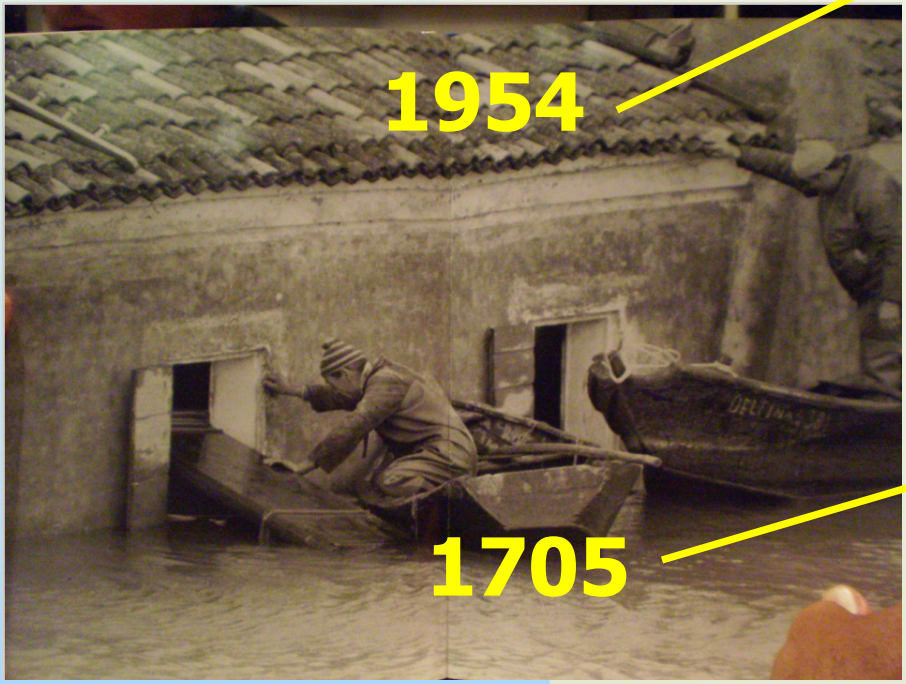
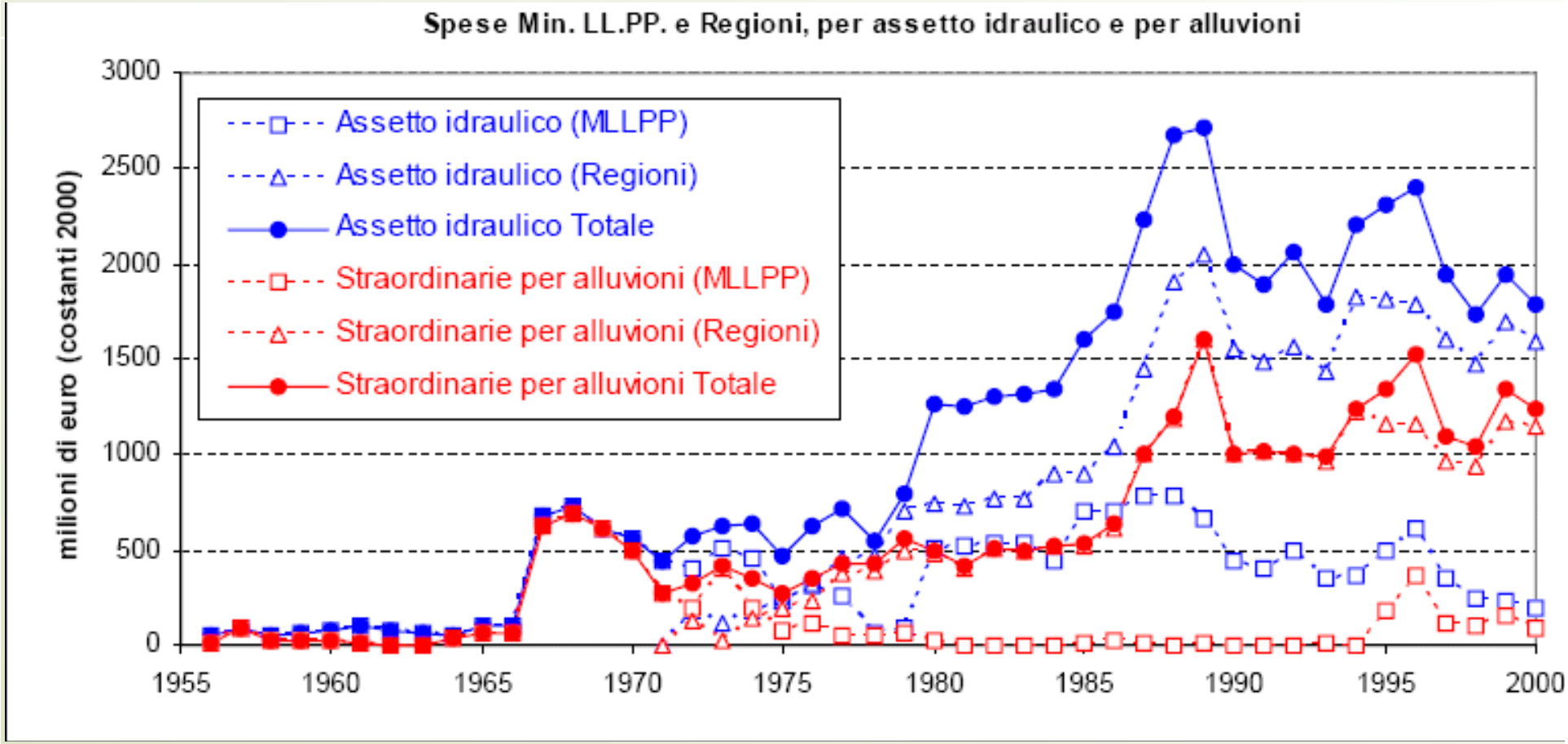
Rio Po: resultado

Hoy…



Rio Po: resultado



...sostenibilidad????

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infrastructuracion =
impuestos en biberon!

Ministero delle Finanze

Carissimo neonato,

benvenuto in questo mondo! Ecco la [illegible] prima cartella delle tasse sui fiumi

[illegible]ni	€	25,00
difese spondali	€	17,00
briglie	€	9,80
dighe	€	7,50
taglio vegetazione	€	4,30
rimozione sedimenti	€	4,30
pulizia tombamenti	€	2,50
derivazioni	€	3,80
canalizzazioni	€	13,00
bonifiche	€	15,50
fognature	€	9,00
acquedotto	€	9,00
depurazione	€	5,60
pennelli e scogliere	€	13,80
ripascimenti	€	12,00
ponti	€	6,50
stabilizzazione frane	€	18,00
danni alluvionali	€	15,70
Protezione civile	€	9,75

ecc., ecc.

RIESGO: Enfoque clasico hidraulico y efectos

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Jarillones, encauzamientos:

⇒ menos espacio al rio: acelera el flujo, menor reduccion del peak, y menor disipación de energia

"Lograr seguridad":

⇒ proteje frente eventos con

$T \leq T^*$ (200)

.....pero esto no es minimizar el RIESGO!

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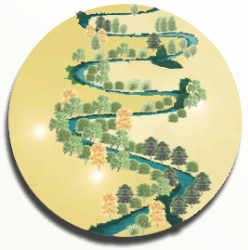
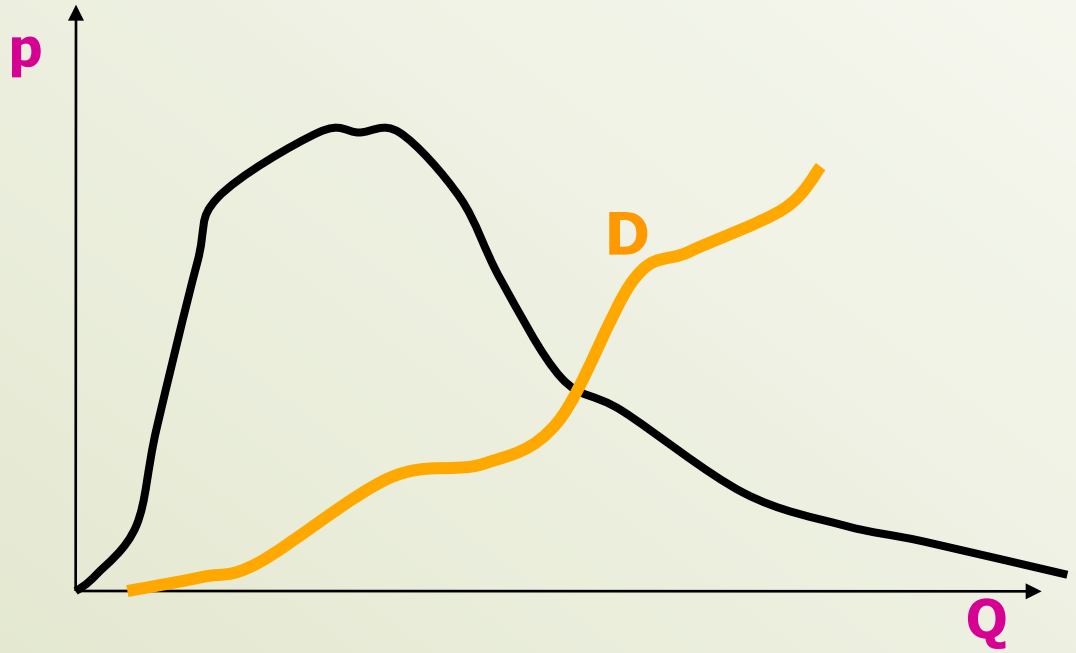
RIESGO: Enfoque clasico hidraulico y efectos



Poner en seguridad ….que' es el riesgo?

$$R_T = \int D(q)\, p(q)\, dq$$



RIESGO: Enfoque clasico hidraulico y efectos

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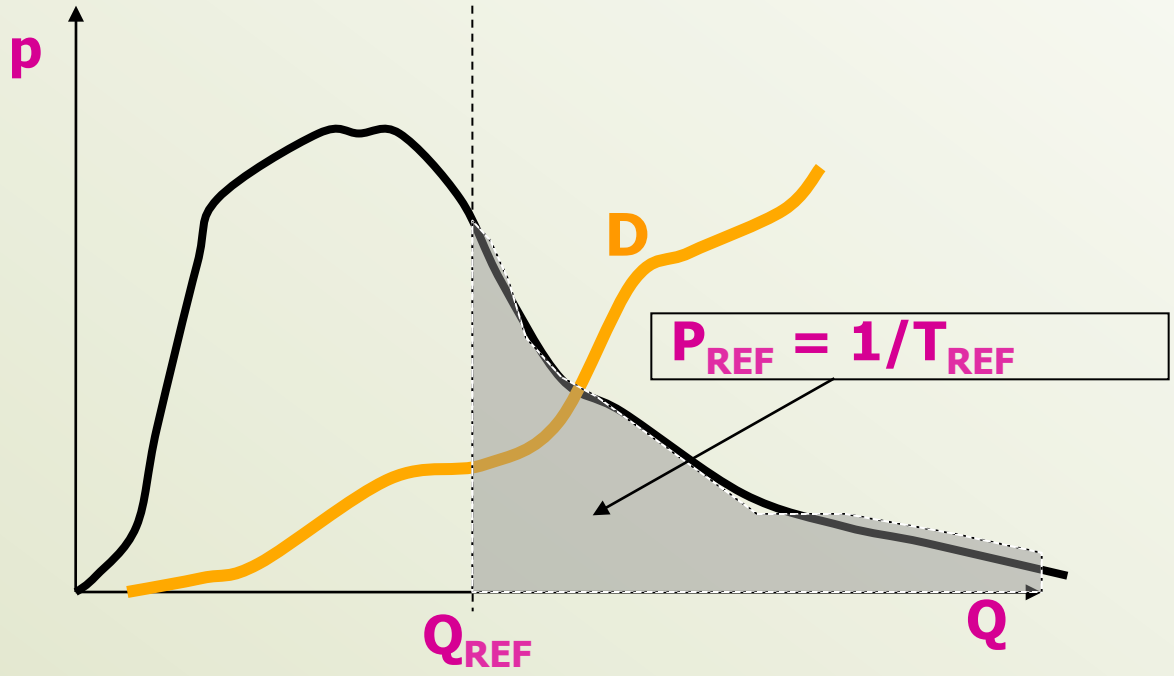
Poner en seguridad ….que' es el riesgo?

$$R_{REF} = \int_{0}^{Q_{REF}} D(q)\, p(q)\, dq < R_T$$



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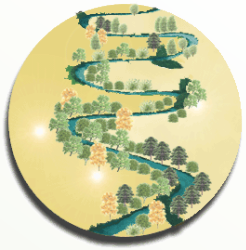
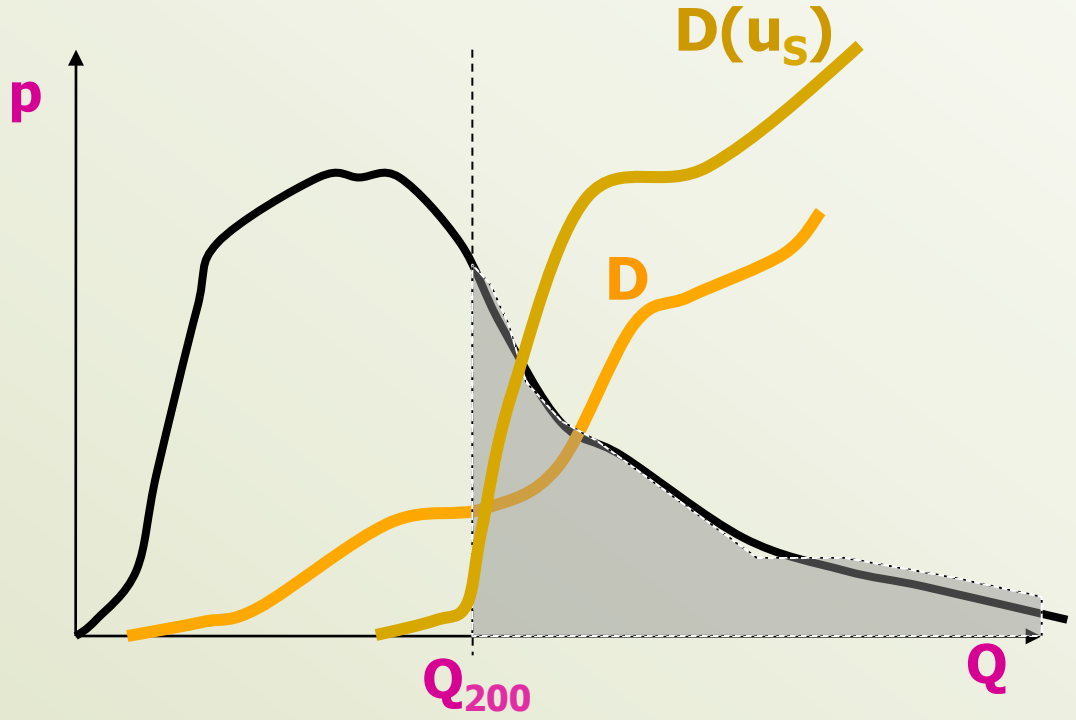
RIESGO: Enfoque clasico hidraulico y efectos



Poner en seguridad ….que' es el riesgo?

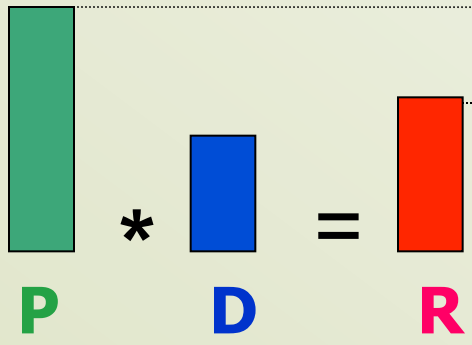
Riesgo depende de las decisiones (u_S) :

$$R(u) = \int D(q,u)\, p(q \mid u)\, dq$$

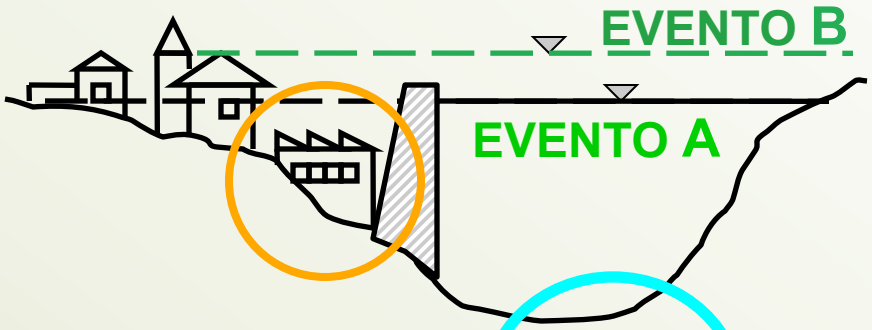


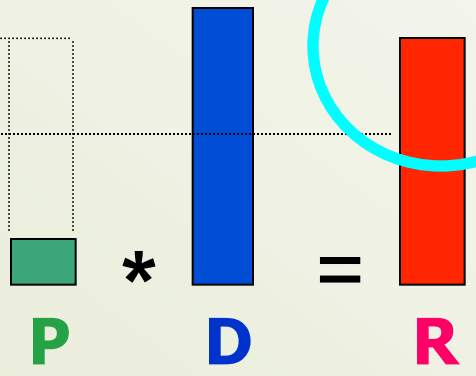
TERRAPLENES para o contra la seguridad ??

ANTES



DESPUES





⇒ **el riesgo ha aumentado !!**

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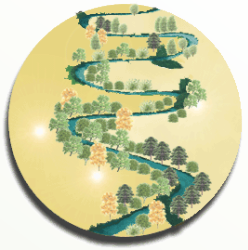
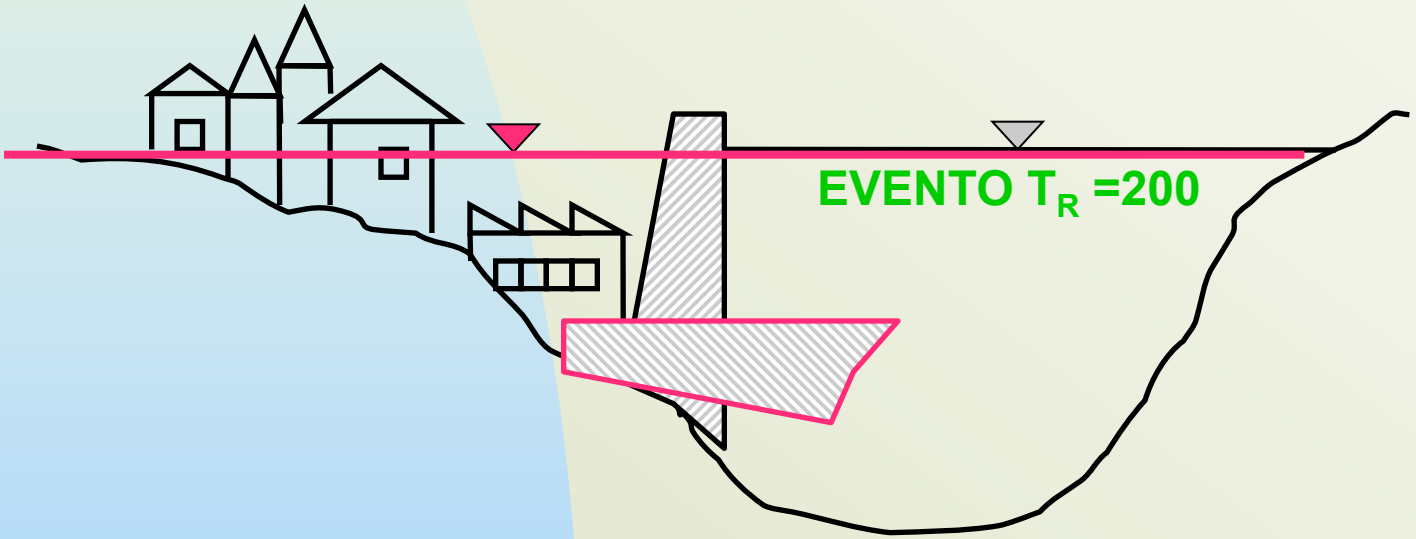
Obras para o contra la seguridad?? ...la *FRAGILIDAD*!



RIESGO: R_{200} = **?**

RIESGO: $R_T > 0$!

$R_T(\infty) >> 0$!!



⇒ *FRAGILIDAD* ALTA….!!!

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Terraplenes para o contra la seguridad?? ...la *FRAGILIDAD*!

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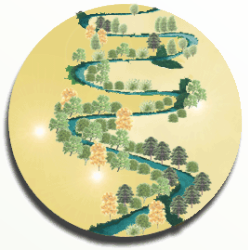
RIESGO hidraulico: visto a-*posteriori*



- Costos de proteccion muy altos e incrementándose
- Dagnos muy frecuentes e incrementándose
- El RIESGO ha aumentado

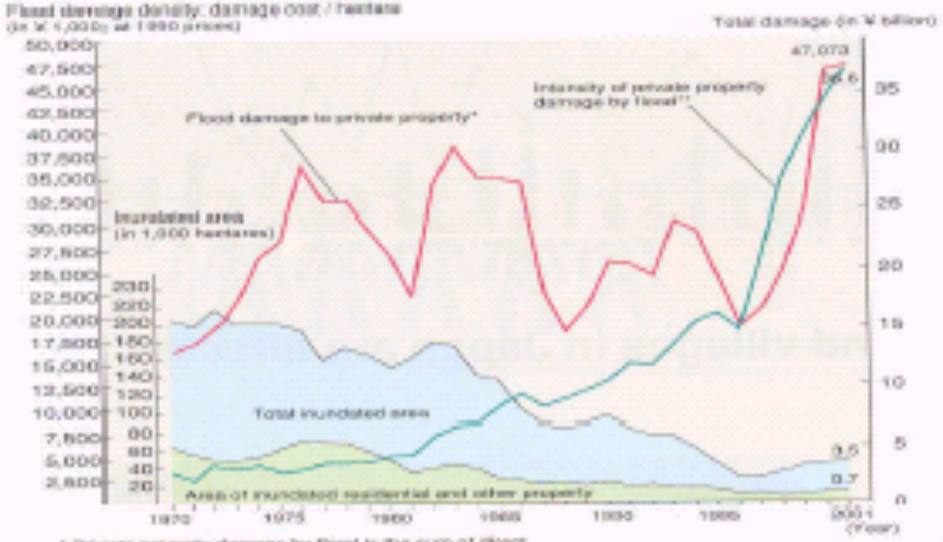
Hablando en general:

el problema no ha sido resuelto

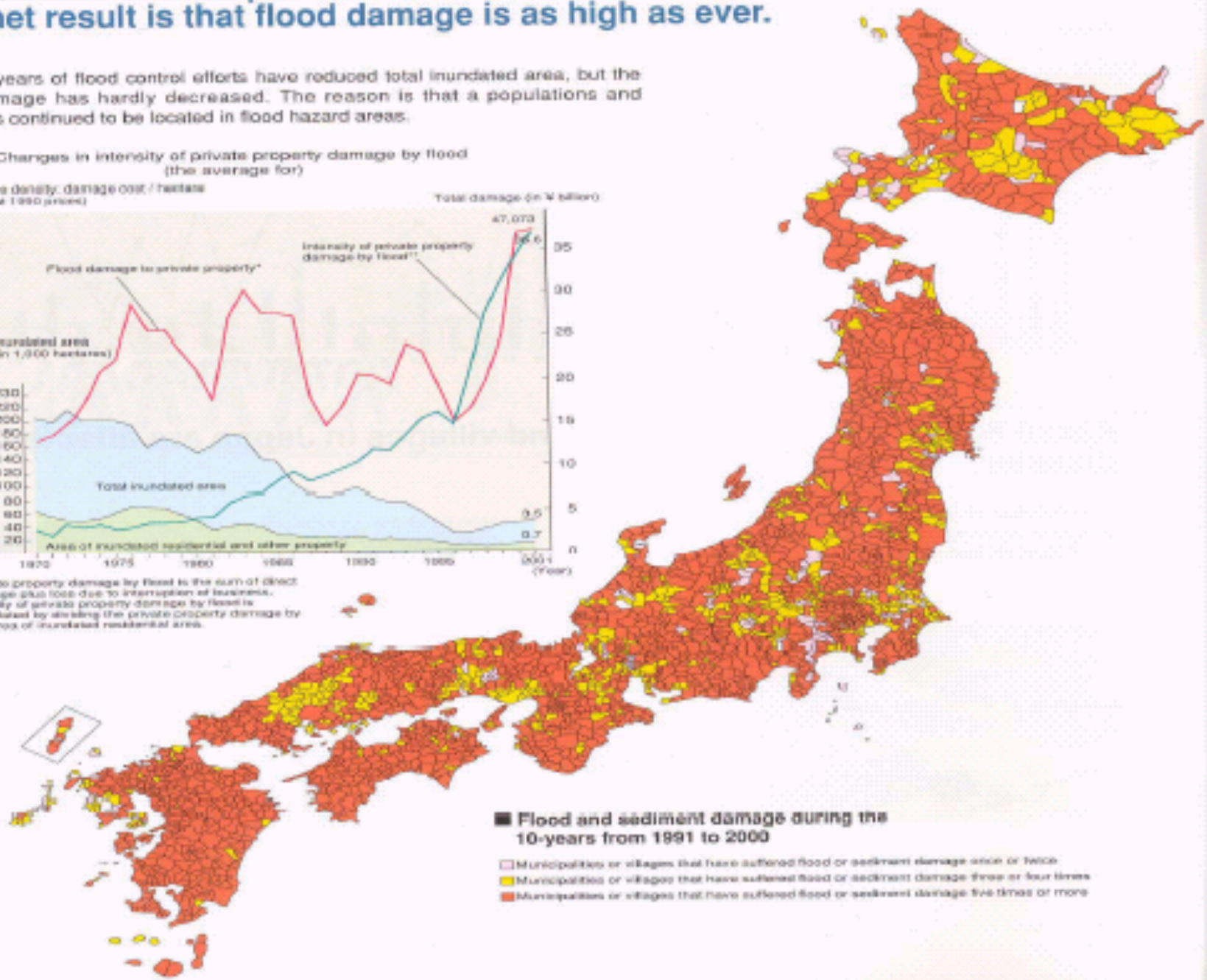
Total inundated areas has been reduced; but property continued to concentrate in flood plains.
The net result is that flood damage is as high as ever.

Many years of flood control efforts have reduced total inundated area, but the flood damage has hardly decreased. The reason is that a populations and properties continued to be located in flood hazard areas.

Changes in intensity of private property damage by flood
(the average for)



* Private property damage by flood is the sum of direct damage plus loss due to interruption of business.
** Density of private property damage by flood is calculated by dividing the private property damage by the area of inundated residential area.



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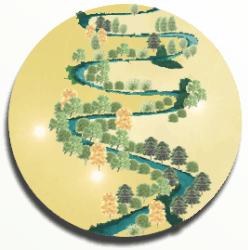
LA RF para la SEGURIDAD



Y entonces:
- cuál enfoque?
- cuáles soluciones?

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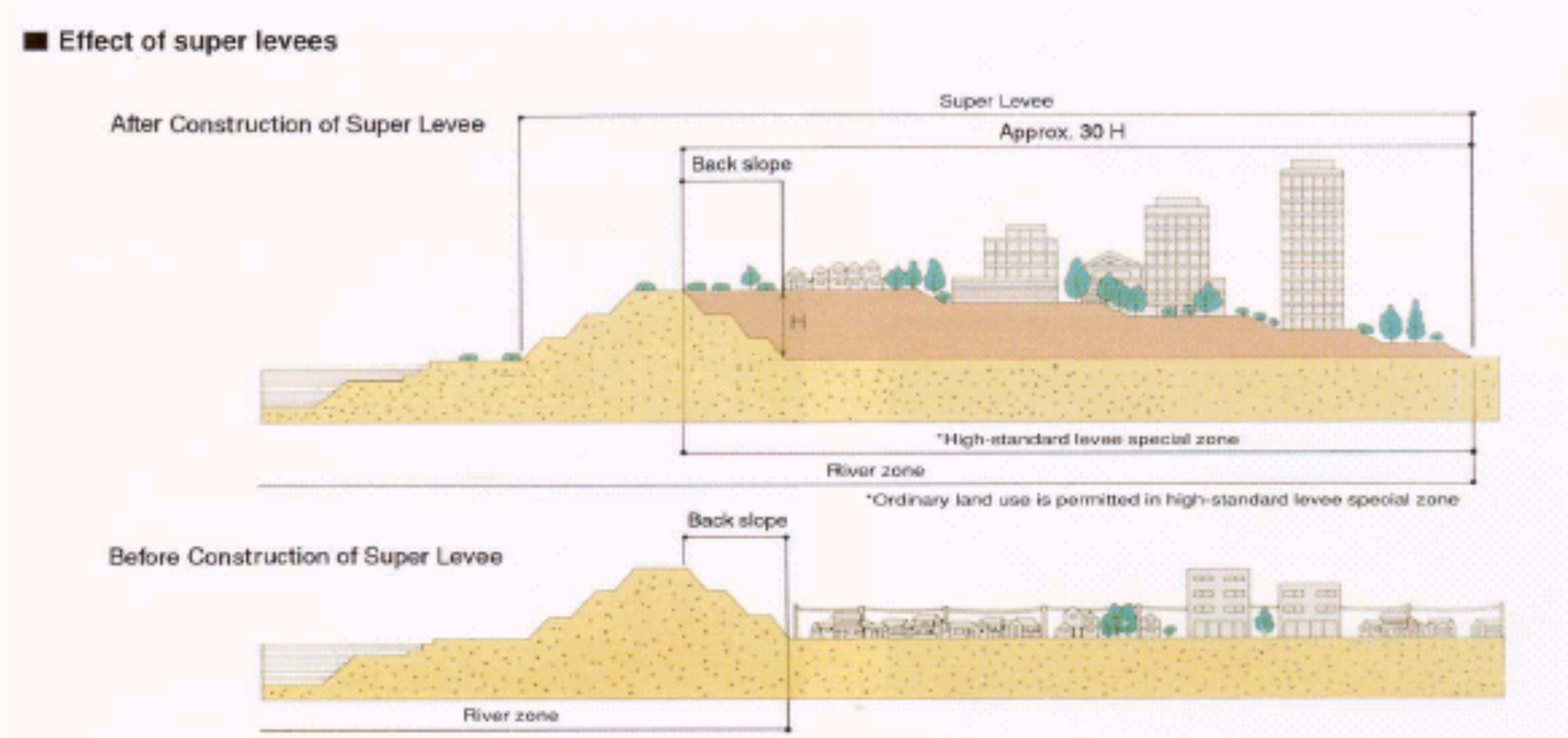
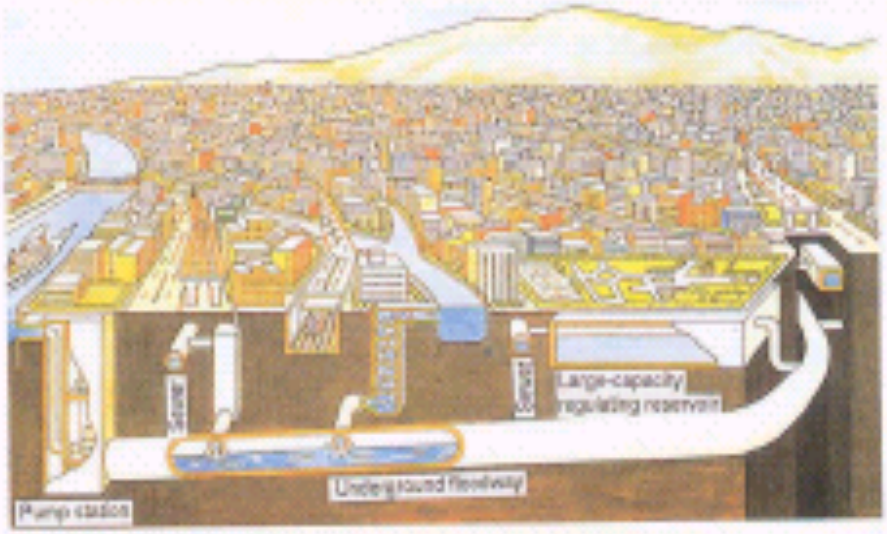
ESTILO JAPONES?

SUPER JARILLÓN



■ Construction of underground floodways and underground regulating reservoirs is an effective means of solving the problem of urban flooding.



In major cities, it is becoming more difficult to construct new surface floodways. Underground floodways and underground regulating reservoirs are underground "rivers" and "ponds" designed to protect the overlying cities from floods.

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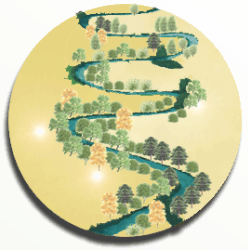
ESTILO "ITALIANO"?



"L'acqua disfa li monti e riempie le valli.
E vorrebbe la terra in perfetta sfericità s'ella potesse"
(Leonardo da Vinci)

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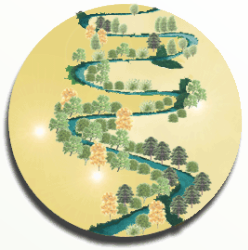
DIRECTIVA FLOODS (UE)



"...*In many cases, traditional engineering solutions (dams, channelisation or dykes) have shown their limits and are more and more* ***uneconomic****. Thus, another approach of flood-risk management is now developed,* ***making space for river and coastal flooding*** *....*

Fostering "the conservation and the restoration of the natural functions of wetlands and floodplains..."

…efecto canalización → perdida habitat acuáticos y terrestres

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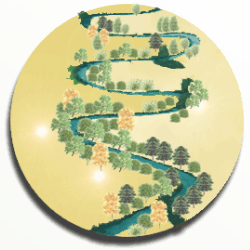
RECUPERACIÓN Ríos:



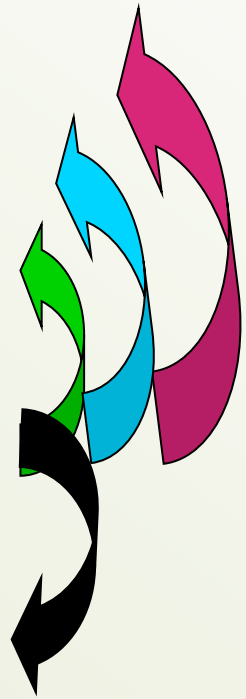
objectivo y medio

- más seguridad
- alimentar actividades antrópicas
- Satisfacer recreación y esparcimiento

RR

- Mejorar los ríos (valor de existencia)

- Reducir costos (inverción y manejo)



ACHIEVE SAFETY ?

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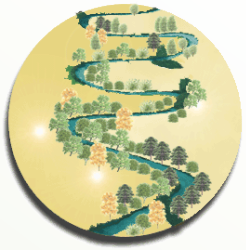

A) Achieve safety (Q_{200})

B) Min Risk TOT

C) Max Net Benefit

D) Max Quality of Life (L)

$$\max_{u} [\, L(u) \,] \cong \max_{u} [\, N(u), -R_T(u), -C(u) \,]$$

With constraint:

- $u \in U$

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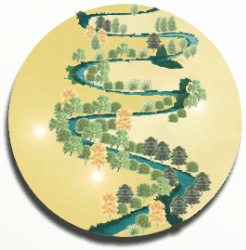
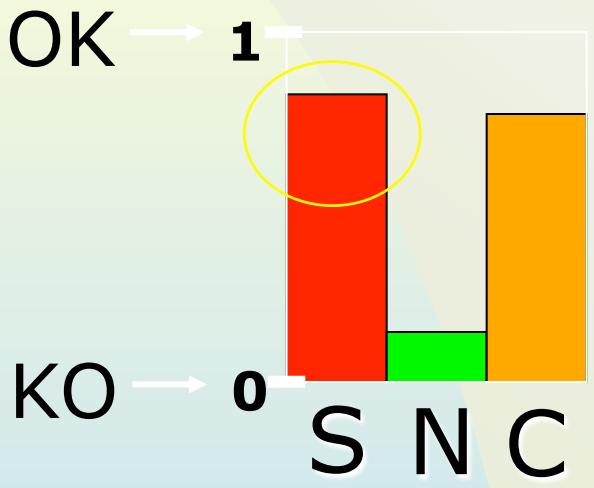
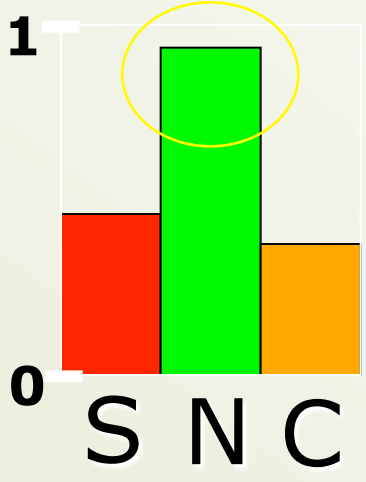
El DESAFIO:
ALTernativas eficientes



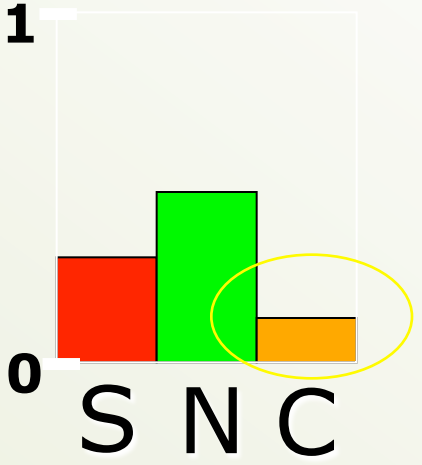
ALT RIESGO



ALT NATURA

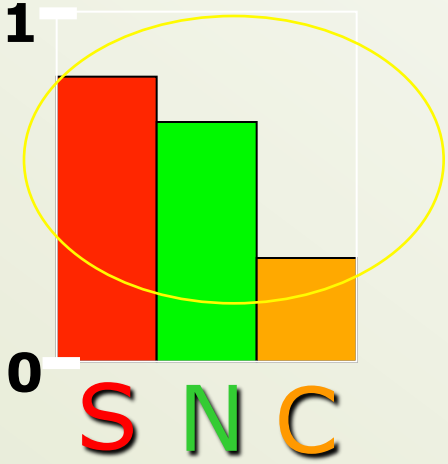


ALT COSTOS



+ ALT MIX 3, 4, …n

ALT ASTUTA?



- escoger ALT "mejor"

- crear mejores ALT: U→U*

+ naturaleza o + obras? (Holanda)

living with floods

Delft Cluster

IRMA

resilience strategies for flood risk management and multiple land use in the lower Rhine River basin

Problem

The Netherlands have a long tradition of protection against floods by dikes. These dikes will have to be raised considerably in the future, when the land subsides further and the design discharge increases due to climate change. The present and future design discharge and related water levels are uncertain, however. The damage behind the high dikes may be huge, if the calculated water levels would be exceeded, and will increase even further with economic development.

Urban development of the city of Arnhem consumed a large part of the room for the river during the past centuries, causing the water level of the river to rise.

Maximum water depth during flooding of the Rhine caused by a peak discharge of 16,000 m³/s at Lobith.

Alternatives

The concept of *Room for the River* has recently been adopted as an alternative for dike reinforcement. Room is mostly sought for in the floodplains. In contrast, *Living with floods* searches for room in the protected areas. This room can be co-used in various ways.

- **Compartimentalisation** and controlled flooding upstream will increase the safety level further downstream and will reduce the flooded area and thus the damage.
- **Discharging backswamps** enlarge the area available for discharge of water and provide opportunities for nature, agriculture, recreation and habitation.

Resilience

An important characteristic of the two alternative strategies is their resilience. The aim is to live with floods instead of to prevent flooding. Room is created for controlled flooding and the land use is adapted to the flood frequency, thus reducing the damage. If an unexpectedly high discharge occurs, the damage will increase only gradually and will not be catastrophic.

The village of Schenkenschanz becomes an island during periods of high discharge.

1997. Flood of the Oder. The task of resilient flood management is to guide such an unexpectedly high discharge (probability < 1/1000 year) to the sea with only limited damage.

Conclusion

All strategies for flood management have advantages and disadvantages related to costs, flood damage, flexibility, economic development, nature, cultural heritage and scenery. In the short term dike reinforcement is the cheapest solution. Resilience strategies, however, result in sustainability in the long term and provide opportunities for nature, agriculture, recreation and habitation strengthening regional identities.

Floodplain forest - wetland nature, which develops on frequently flooded terrain.

New nature along the rivers is very well suited for recreation.

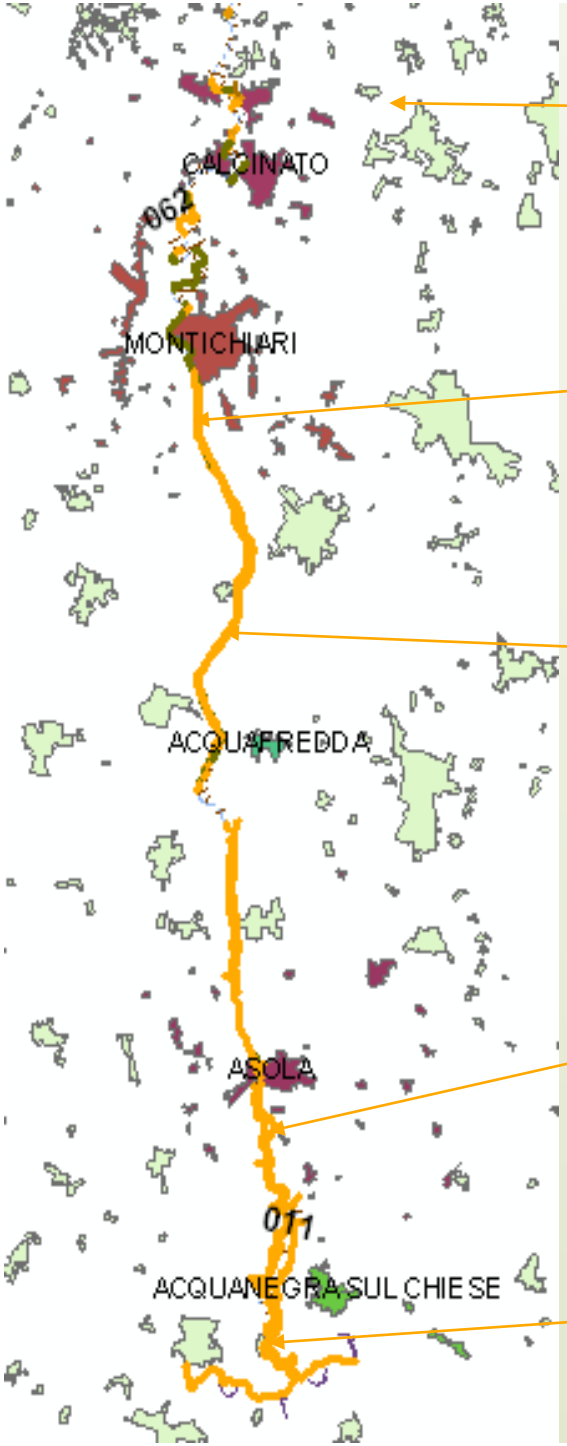
Living with floods is a project by NCR and Delft Cluster and is sponsored by IRMA.

ACCIONES para RR

Río CHIESE (TN, BS)

- Área cuenca: 1400 km2
- L río: 180 km
- L estudiado: 80 km
- Q media: 33 m^3/s
- Q 200: 750 mc/s
- V Hidro: TOT 747 Mm^3
  Útil 75,5 Mm^3


110
44
91
03
16
27
28
29
ACQUANEGRA SUL CHIESE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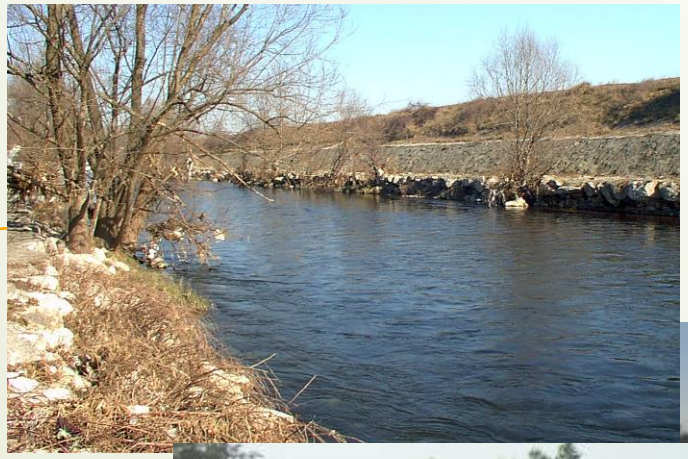

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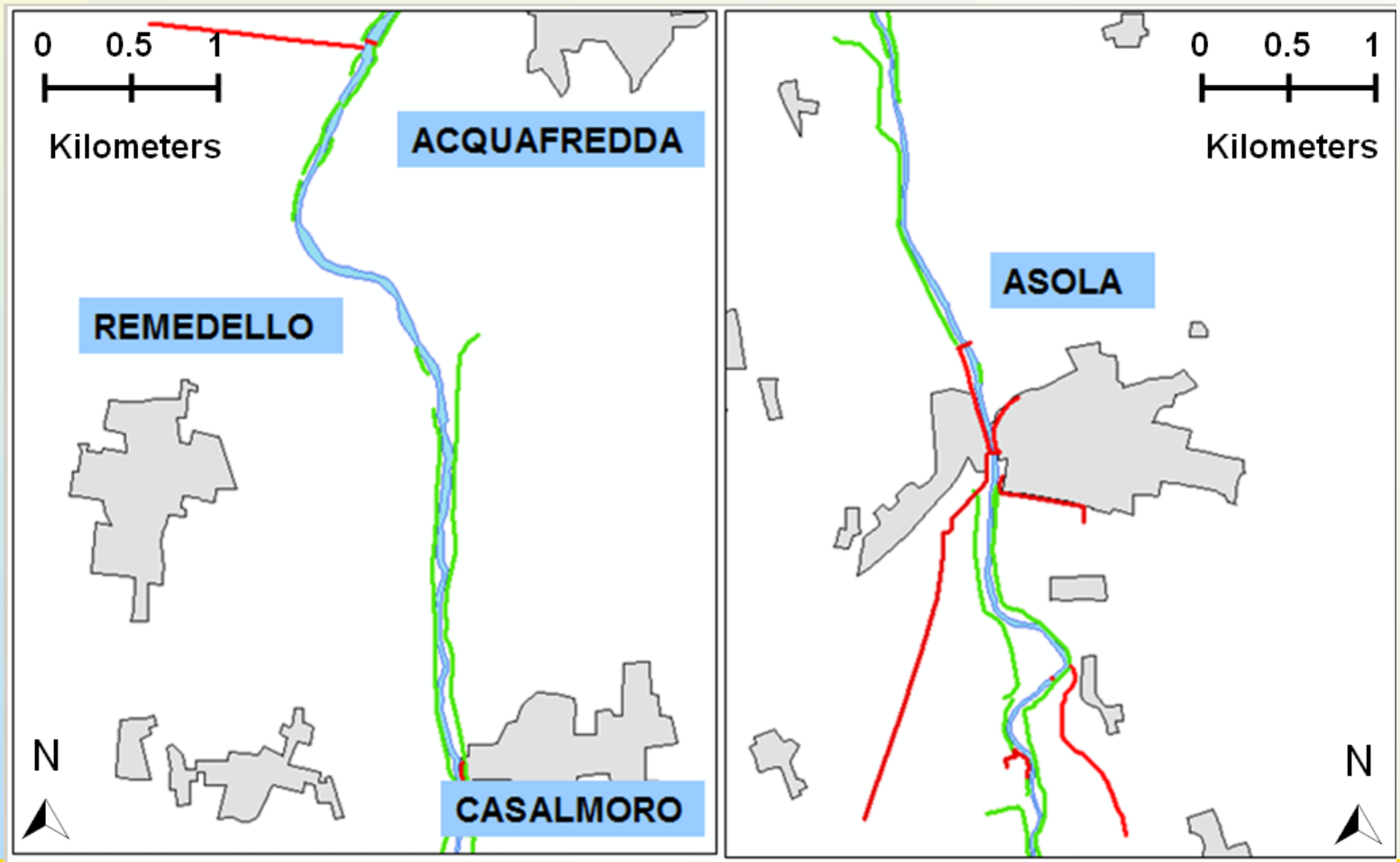
DEFINICIÓN de las ALTERNATIVAS: ALT_Base*



- en **fucsia**: rebajar azud
- en **azul**: obras eliminadas respecto a las existentes

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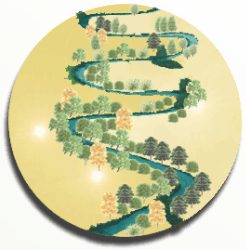
EVALUACIÓN: RESULTADOS ACB ALT_Base*



ITEM	BENEFICI	COSTI
	In Milioni di EURO	
RISPARMIO OPERE esistenti da dismettere (OMR) o da non fare (OMR+invest.) tra ALT_x e ALT_0 (evoluzione di "stato attuale")	185.27	
Investimento e OMR nuove opere da realizzare (SdF + "CIRF")		65.84
D Manutenzione Alveo	17.72	
Δ rischio esondazione rispetto ad ALT 0		22.16
Δ rischio erosione rispetto ad ALT 0	7.09	
Δ valore Uso suolo nell'ALT x rispetto ALT 0		1.26
Perdita produzione idroelettrica da traverse dismesse		0.00
Δ FRAGILITA'		
Δ Valore fiume (miglior stato ecologico)		
Δ esternalità (squilibrio trasporto solido e laminazione)		
TOT	211.45	89.25
	B netto	122.2

Horizonte evaluación T = 50 años ; tasa de descuento r = 5%; OMR: "CIRF"

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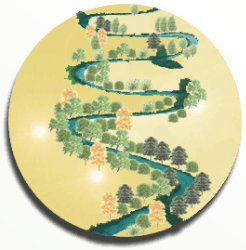
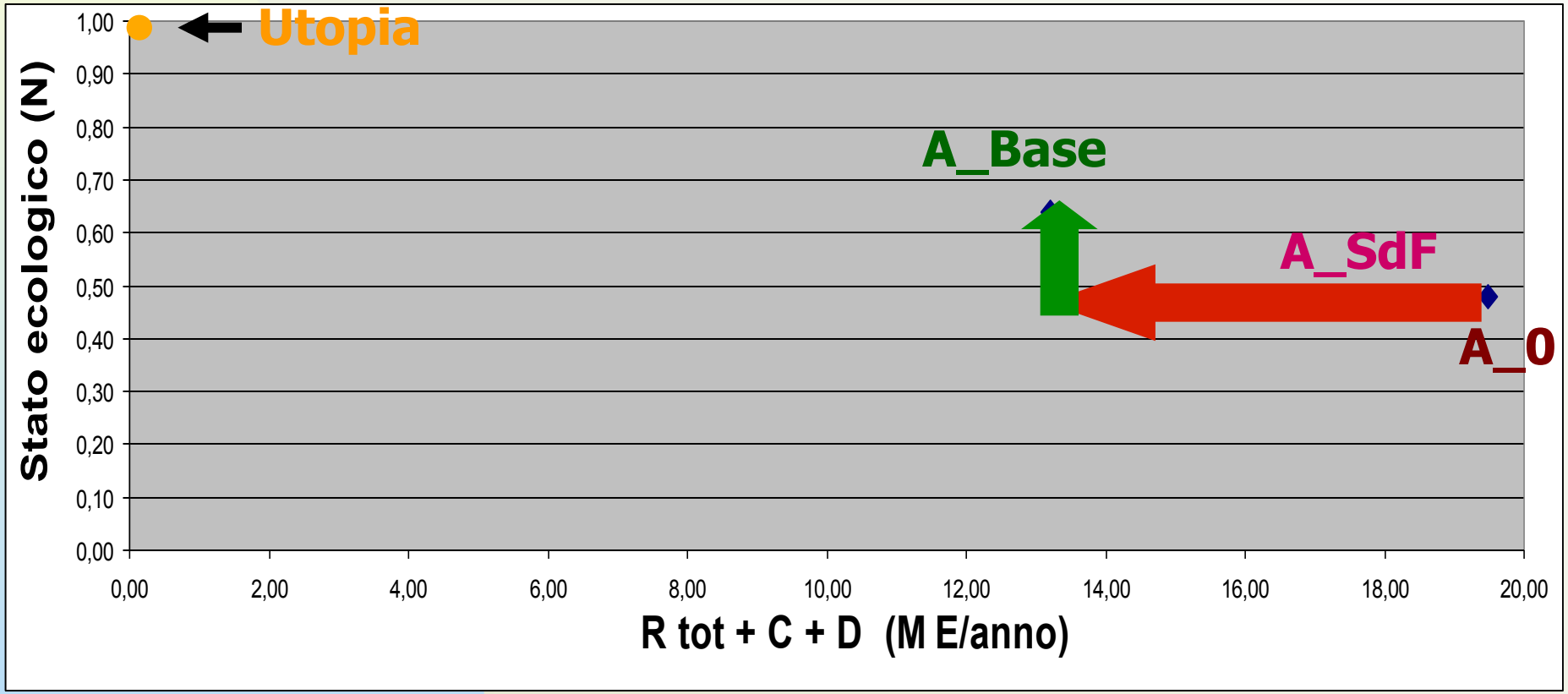
EVALUACION : enfoque: MULTI-OBJETIVO





Orizzonte T = 50 anni; tasso sconto r= 5% ; OMR: "CIRF"

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RECUPERACION de RIOS y RIESGO HIDRAULICO

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