International Conference on "Landslides and Climate Change – Challenges and Solutions"

Ventnor, 24th May 2007

Economic assessment of natural risks due to climate change.

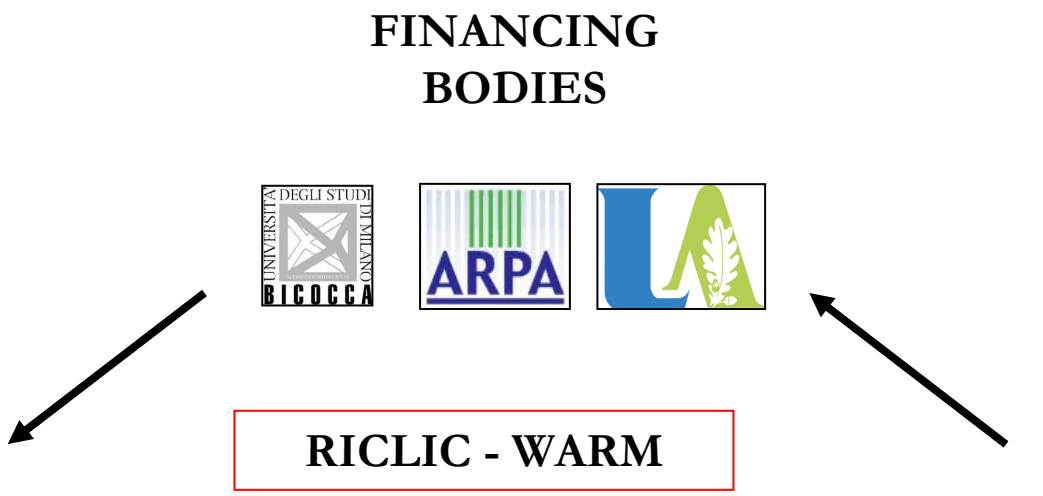
The case of a mountain Italian region.

Paolo Giacomelli, Marta Brambilla

RICLIC WARM – Regional Impact of CLImate Change in Lombardy Water Resources: Modelling and applications.

FINAL GOALS

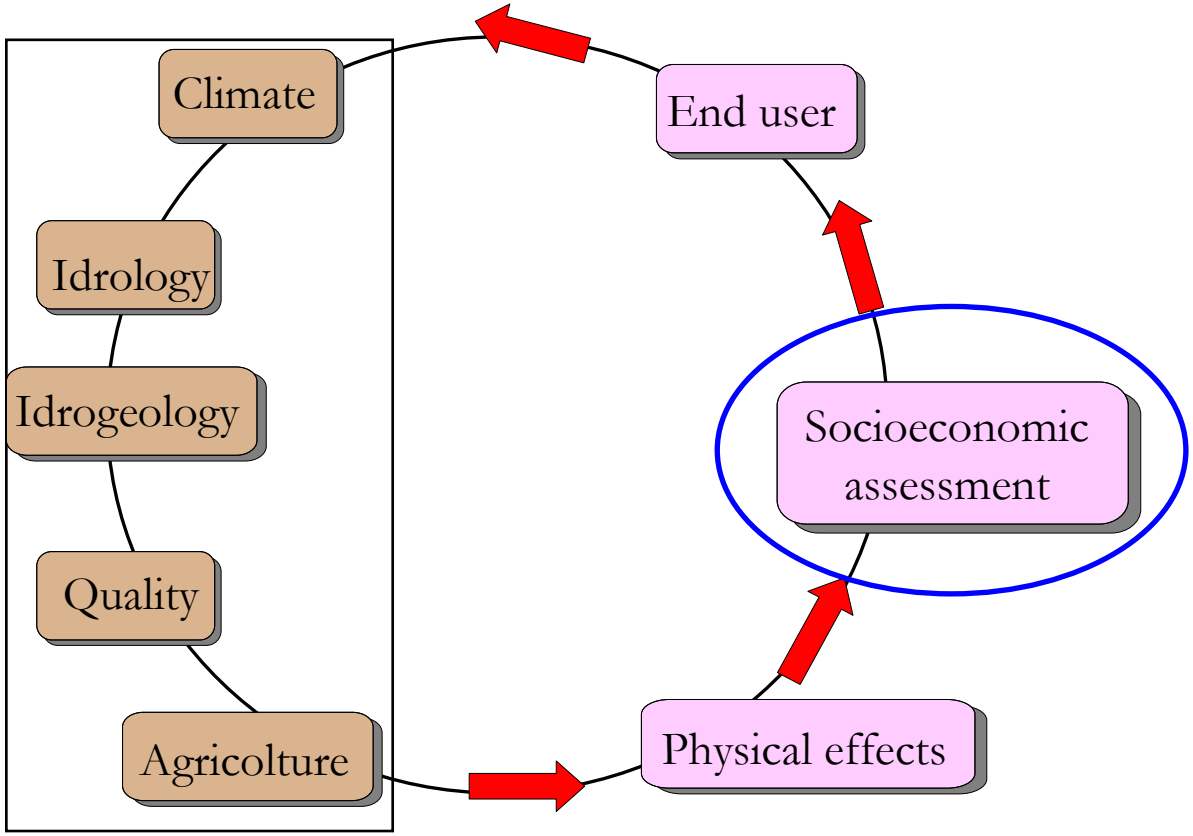
Develop a scientific methodology to assess climatic impacts on water resources and provide a support to decision-making processes on water management



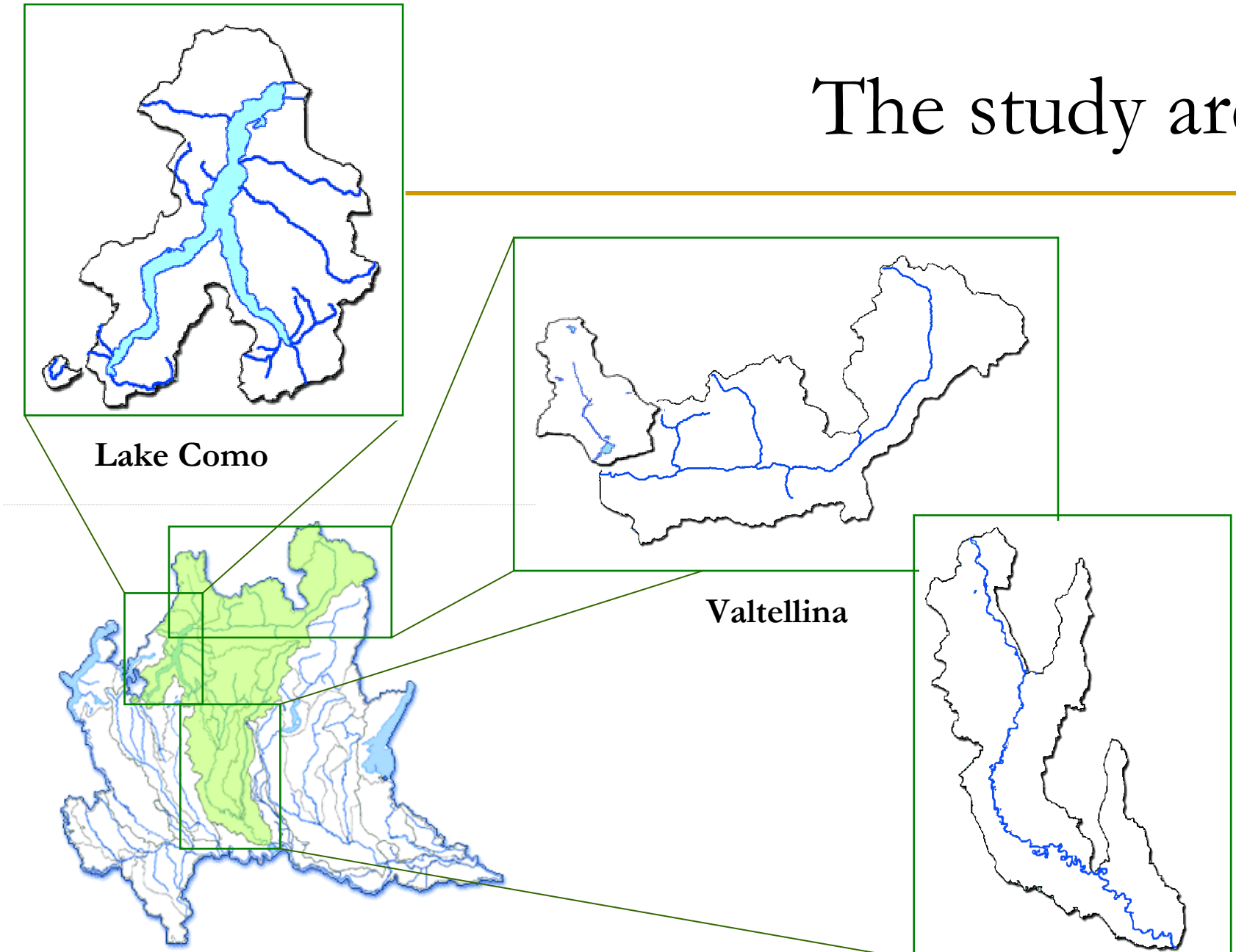
- University of Milano – Bicocca
- University of Milano
- University of Pavia

- Regione Lombardia
- ARPA Lombardia (Regional environmental protection agency)

The RICLIC project organization



The study area



The geologic approach to risk

$$\mathbf{R = H * V * E}$$

Varnes, 1984

Problems:

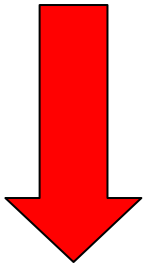
• Vulnerability: we prefer to talk about structural and not structural damages;

• The value of the elements involved it is not the only economic factor with wich it is possible to describe effects;

• Money value for human life.

The suggested approach

CAUSE → EFFECT



RISK AS A LEVEL OF DAMAGE

1° Phase

Landslide phenomenon itself

Identification of the physical cause and physical effects

Physical damages to structures involved

2° Phase

Assessment of *economic damage* :

direct e indirect

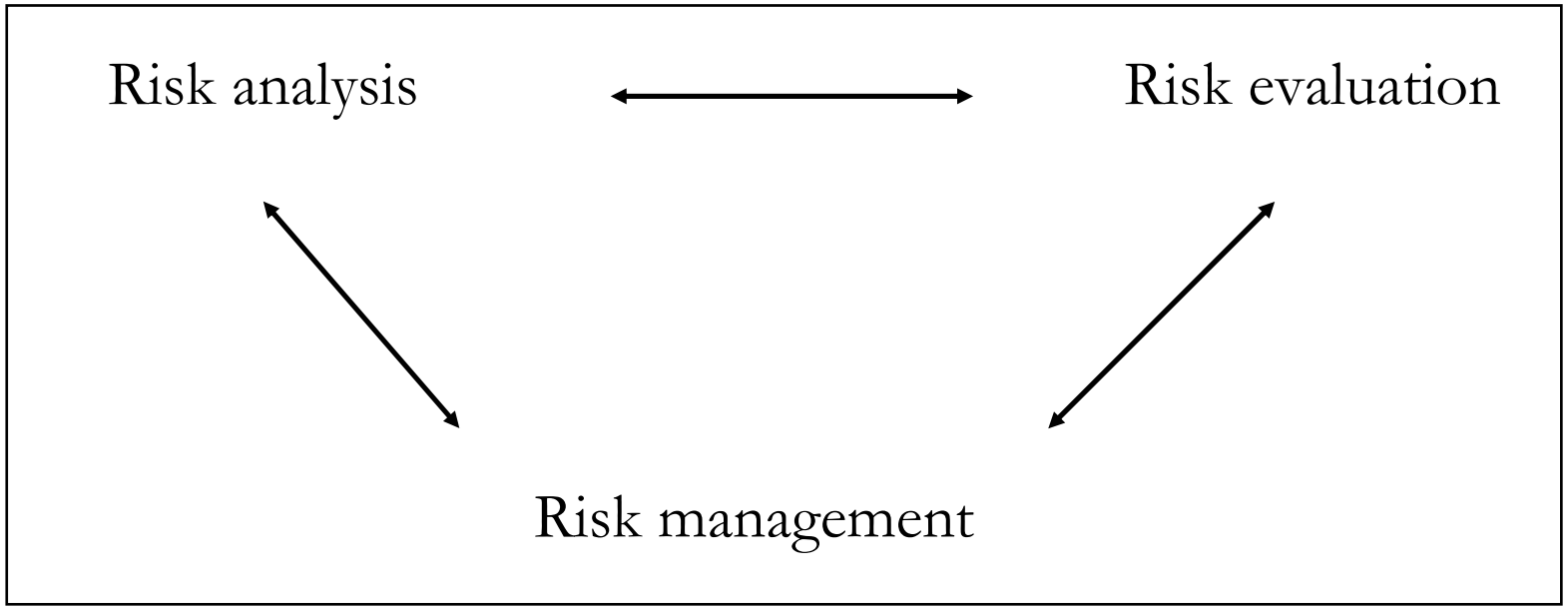
Cost to restore the elements involved

Cost due to the interruption of the economic activity..

..in the landslide scenario

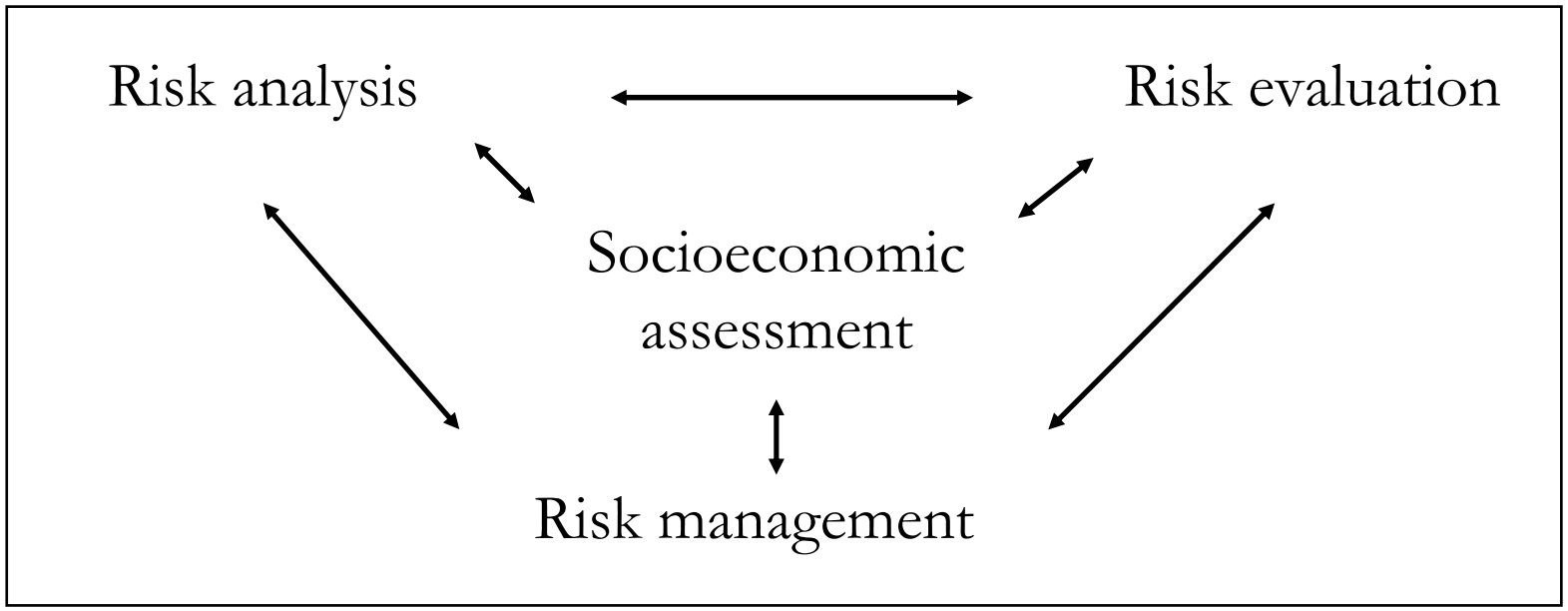
..out from the landslide scenario

Integrated holystic concept of risk assessment



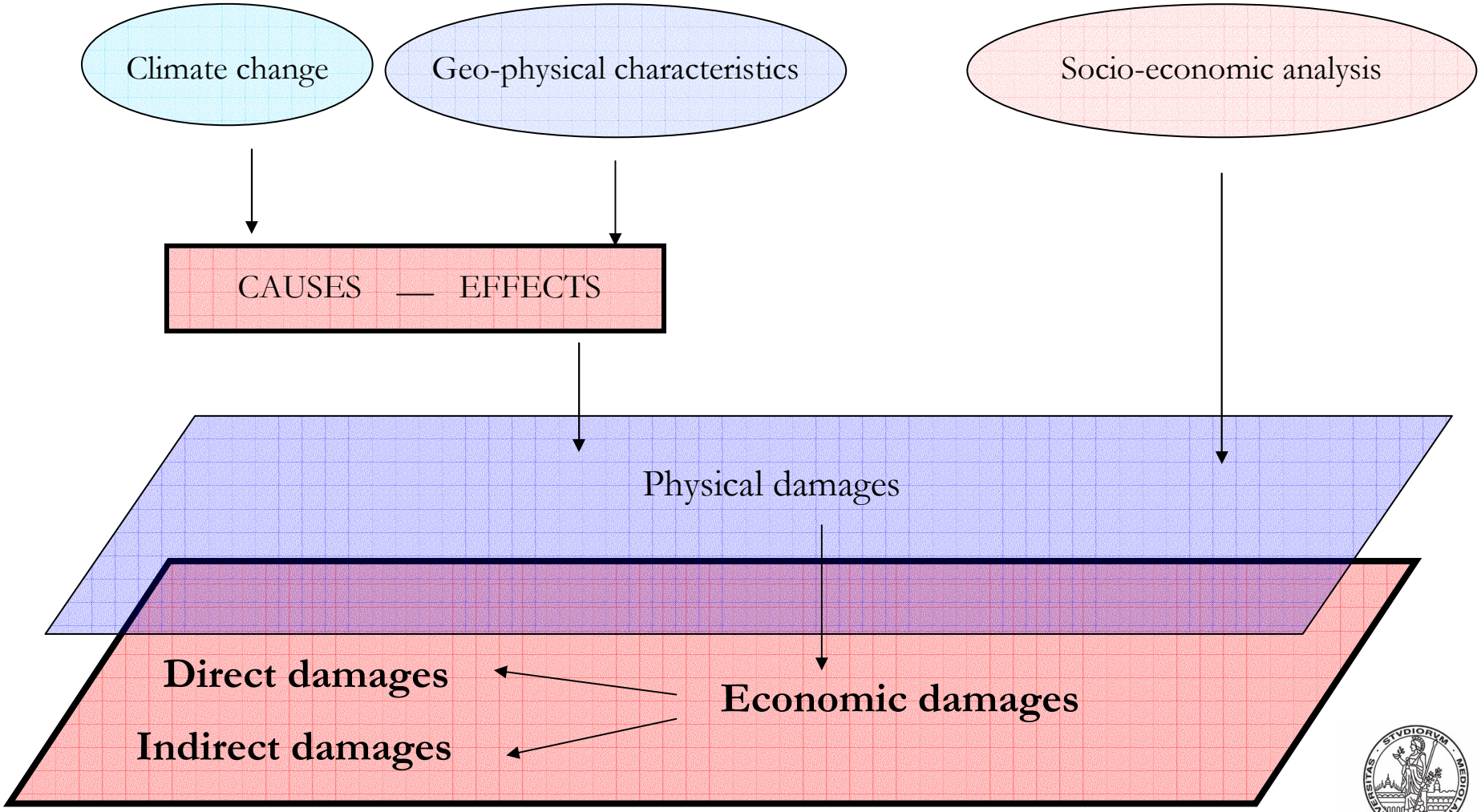
Bell e Glade, 2004

The integration of socioeconomic assessment into the holystic concept of risk

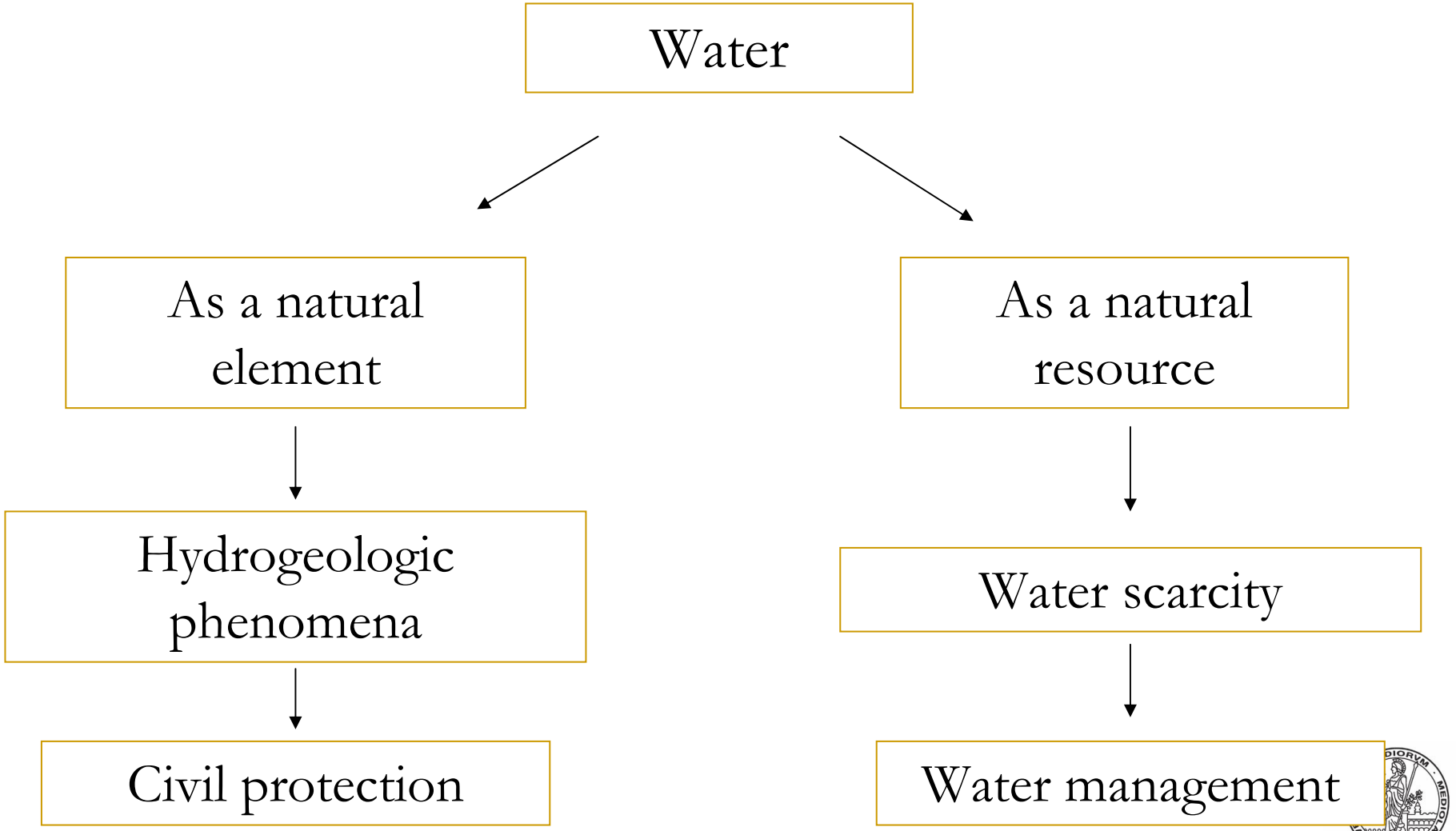


Modify from Bell & Glade

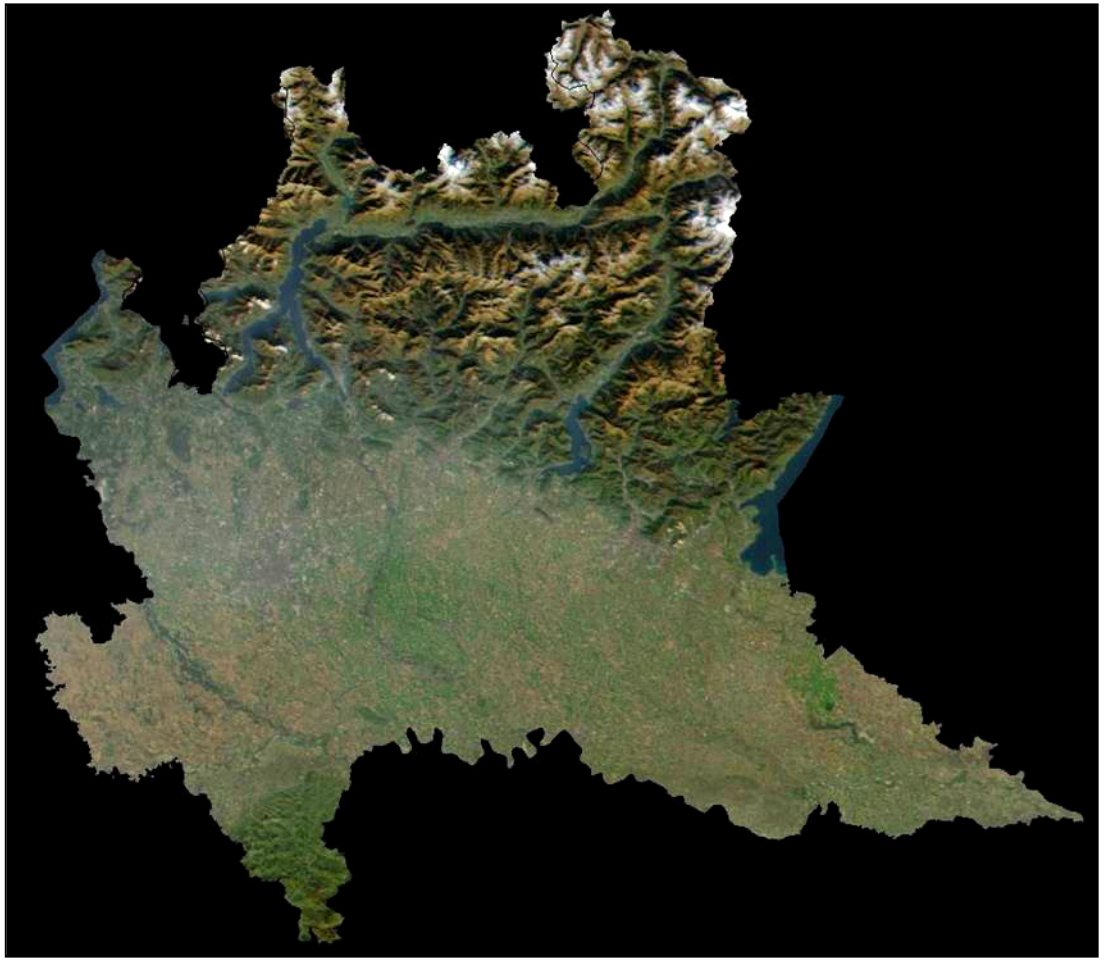
The RICLIC project



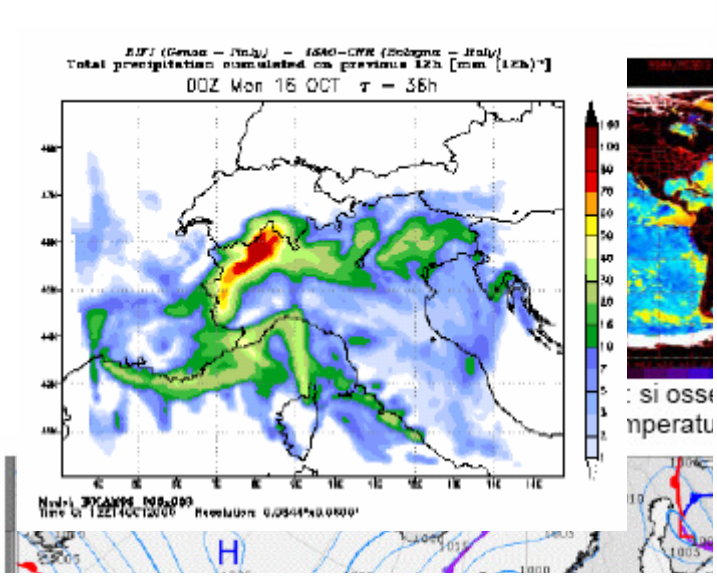
The water management system

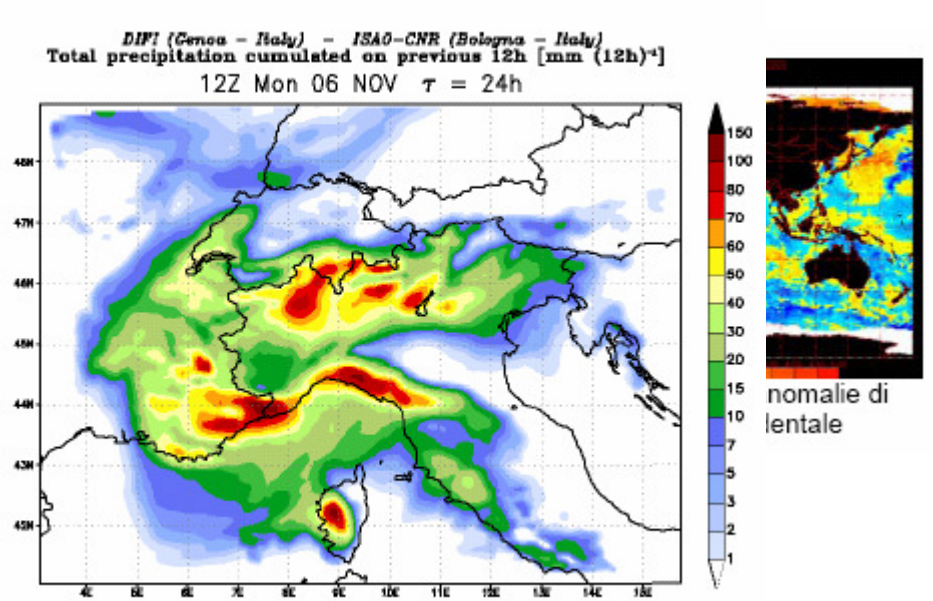


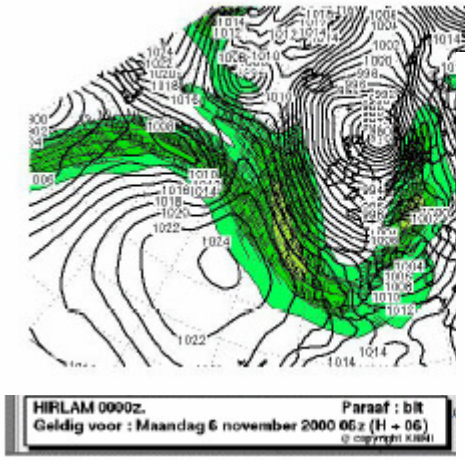
The study area

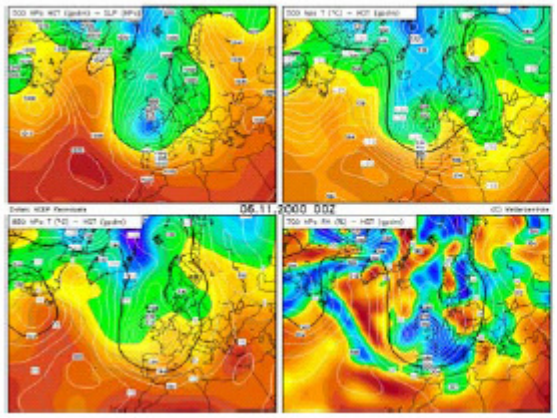


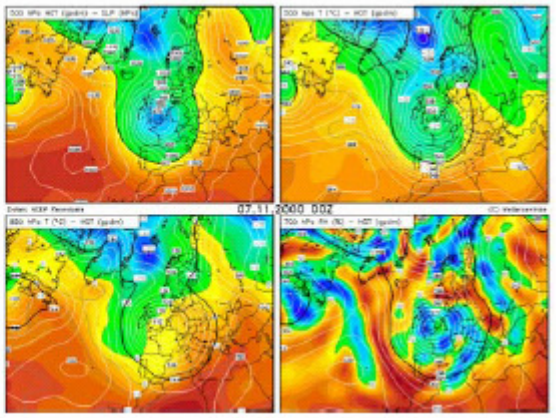
Meteo – climatic data











Case history

Source: Arnaldo Zitti (2006)

PHYSICAL CHARACTERISTICS

- July 1987
- 10 days of heavy rain
- 305 mm rain in 24 h
- 35 millions m^3 debris flow

Case history

Source: Italian Red Cross (1987)

EFFECTS

- Damages for 162 municipalities
- 49 dead people, 12 lost e 31 injured
- 20.000 evacuated people
- 144 houses and a hundred of rural buildings destroyed (407 people homeless)
- 50 people out of work
- 2 months to build temporary tracks
- Estimated economic damage 500 e 1.000 millions € (1987).

GOVERNMENT SET ASIDE 1.200 MILLIONS € FOR THE "REBUILDING AND DEVELOPMENT PLAN"

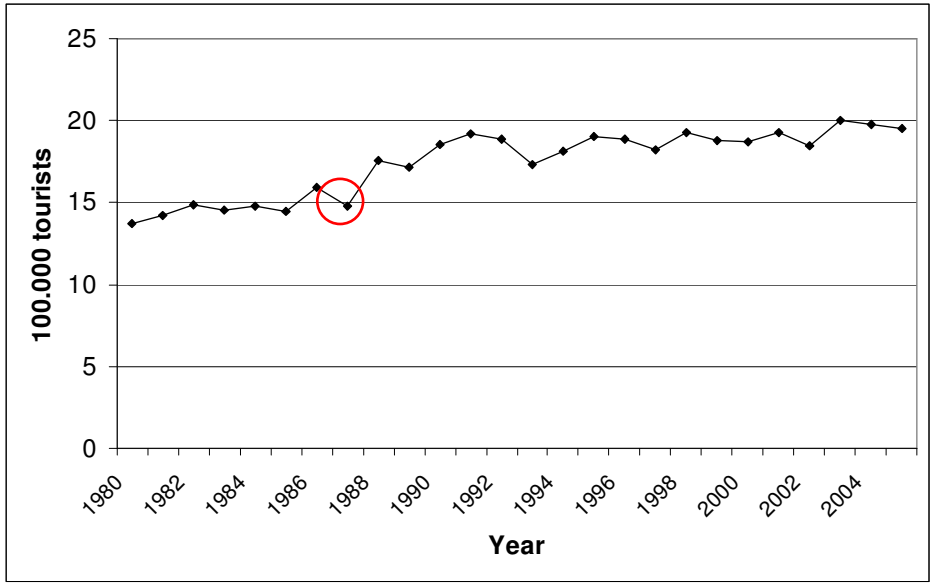
Tourism in Valtellina

- >1/3 added value
- 69.1% province income → tertiary sector (tourism oriented)
- Weekend tourism and commuter tourism
- Economic integrated system
- Alta Valtellina: main touristic area

Passo di Foscagno
Valdidentro
Cresta di Réit
3075
Bormio
Punta la Stretta
3104
M. Campaccio
3007
2883
M. delle Mine
M. Foscagno
3058
39
301
3049
Piz Minor
Pizzo Filone
3133
Piatta
Sant'Ar
3057
M. Vago
Corno di S. Colombano
3022
Cima dei Piazzi
3439
M. Vallece
3148
3232
Corna di Campo
Valdisotto
M. Sobretta
3296
Corno Dosdè
3233
Cima Viola
3374
Pizzo Bernina
4049
3906
Pizzo Palù
3257
Cima
Sapseo
Pizzo Roseg
3936
Pizzo Zupò
3996
Cime Redasco
3139
Pizzo delle
Tre Mogge
3594
Vetta Sperella
2913
Monte
del Forno
3214
3345
Sasso di Fora
2628
P.so
Confinale
3075
Sasso Campana
Frontale
Monte Rosso
3088
Ravisce
Chiareggio
2636
Sasso
Moro
Poschiavo
M. Storile
Sondalo
P.ta di
Pietra Ro
Cima Castello
3378
2734
Sasso Nero
3108
Pizzo
Sassalbo
2855
2471
Fusino
Cima di Rosso
3369
Cima del Duca
2953
2464
P.so di Canciano
Cèngalo
2336
Franscia
Le Prese
Pizzo
Banderuola
2831
Grosotto
Grosio
2967
M. Serottini
Pizzo Cassandra
Primolo
Lanzada
Pizzo Scalino
3323
M. Disgrazia
3678
3226
L. di
Poschiavo
Brusio
2816
Mazzo
di Valtellina
Caspoggio
Chiesa
in Valmalenco
San Martino
A. Campiascio
Vervio
Vezza
d'Oglio
3114
Corni Bruciati
2669
3136
Vetta di Ron
Prà Campo
Tovo
di Sant'Agata
380
M. Caldenno
Torre
di S.ta Maria
2807
C.no Mara
Mad. di Tirano
2449
C.ma Cadi
19
404
Búglio
in Monte
2522
M. Canale
Incudine
18
Barbenno
di Valtellina
SONDRIO
Poggiridenti
Ponte
in Valtellina
Villa
di Tirano
Tirano
L. d'Aviolo
M. Avio
2962
Piateda
Edolo
Castione
Andevenno
Chiuro
Teglio
Sonico
C.no d.
Granate
Colorina
38
17
39
Cortenedolo
Talamona
Fusine
Caiolo
Albosaggia
Aprica
29
Piz Tri
2309
13
Rino
3108
Campo
Castello
dell'Acqua
Carona
2385
Punta

The Valtellina landslide: effect on tourism

	Bormio	Valfurva	Sondrio Province
	%	%	%
1980			
1981	-7	13	4
1982	2	14	4
1983	-4	-14	-2
1984	3	3	2
1985	4	9	-2
1986	4	15	9
1987	-17	-25	-8
1988	22	23	16
1989	-9	14	-3
1990	13	9	8
1991	3	-9	3
1992	-7	-6	-2
1993	-16	-1	-9
1994	4	1	5
1995	6	3	4
1996	-1	-1	-1
1997	1	-7	-4
1998	2	7	5
1999	-1	-1	-3
2000	-6	-6	-0,3
2001	2	4	3
2002	-3	-15	-5
2003	4	9	8
2004	-5	-2	-1
2005	0,2	-19	-1



Source: Tourism promoting office

Importance of network facilities

- Closure of SS38 → most important and faster connection between Colico and the Alta Valtellina

Take home message

TECHNICAL SCIENCES ⟷ ECONOMICS

exchange of knowledge

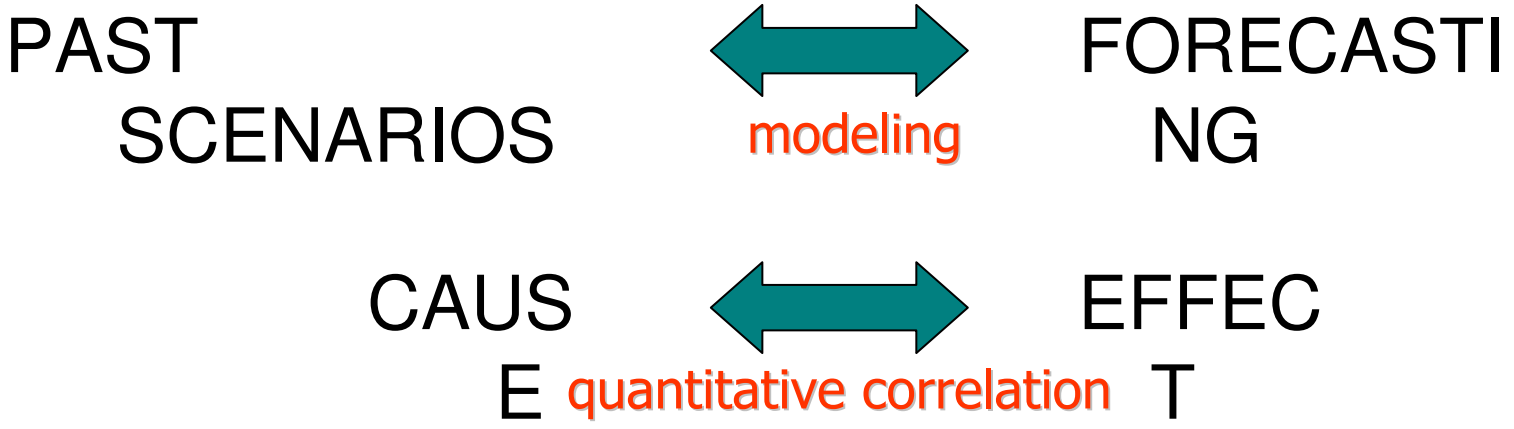
CAUSE ⟷ EFFECT

quantitative correlation

DIRECT DAMAGES ⟷ INDIRECT DAMAGES

space and time perspective

TAKE HOME MESSAGE



Conclusion

- The importance to share knowledge between different group of work, in order to achieve a better understanding of the system
- Climate change could worsen the effect on social stability because is carrying on an intensification of physical causes
- As tourism produces >1\3 of the whole added value of Sondrio province, any damage to tourism could compromise the socioeconomic equilibrium of the area
- The importance of network facilities in the determination of indirect damages, that could widen the area affected in space and time
- The importance to consider the socioeconomic background in order to plan the assets of the area

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