Changes in the Alpine Environment and Trends in Winter Tourism: Current Challenges and Solutions

Carmen de Jong



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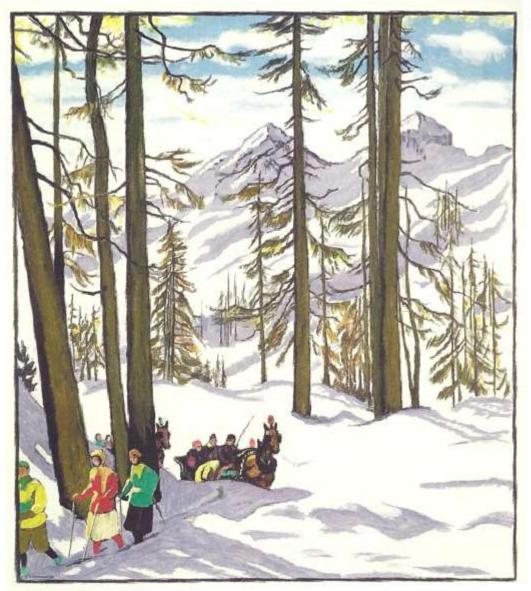
nvironnement

I-LivAlps "Winter Tourism in the Alps", Lecco



1) How is climate change affecting winter tourism?

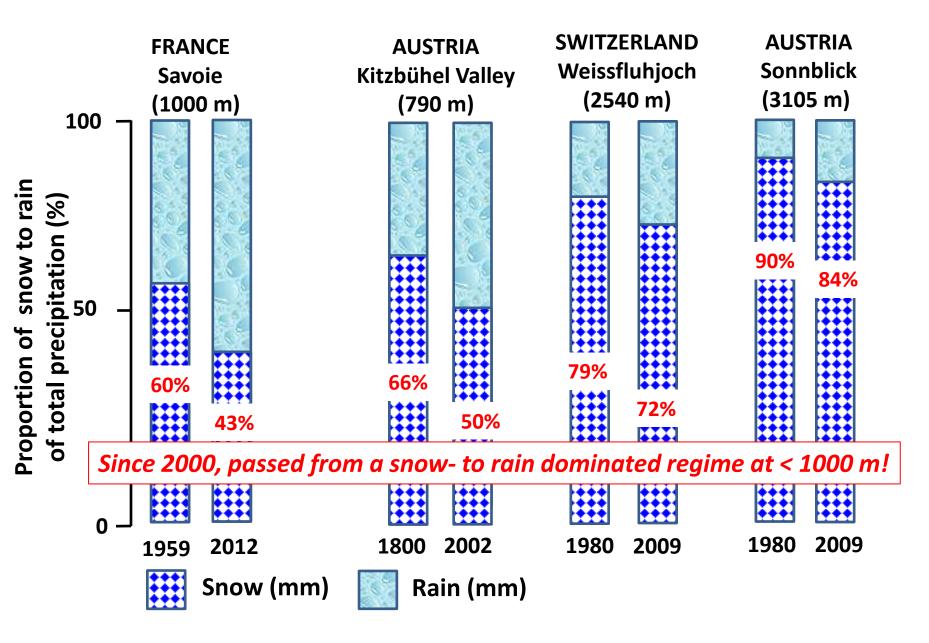
St. Moritz "soft winter tourism" (Switzerland)



Nordic Skiing and wooden horse-drawn sledges

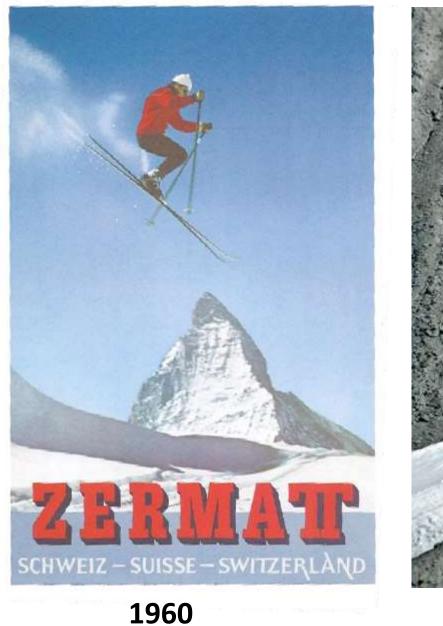
Cardinaux 1918

Is Winter Tourism compatible with Climate Change?



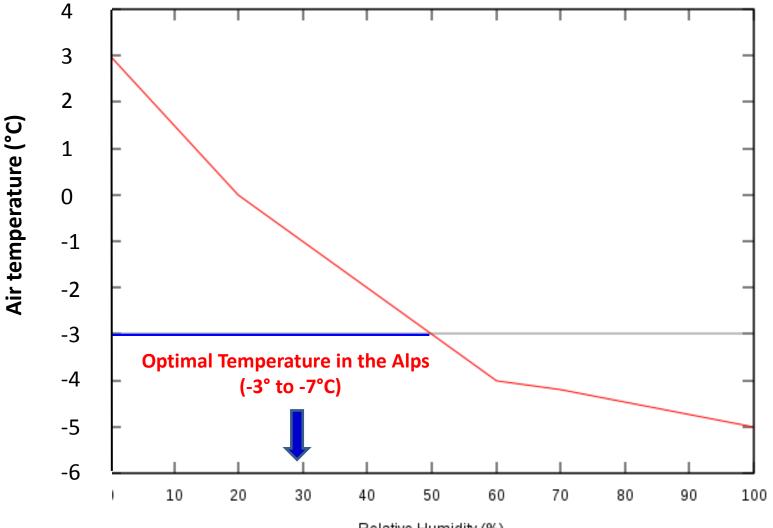
Data from Météo France 2008 and Marty & Meister 2012

Skiing in Zermatt in 1960 and 50 years later.....



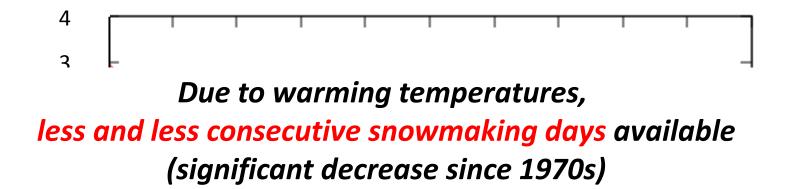


Meteorological Limits for Artificial Snow Production

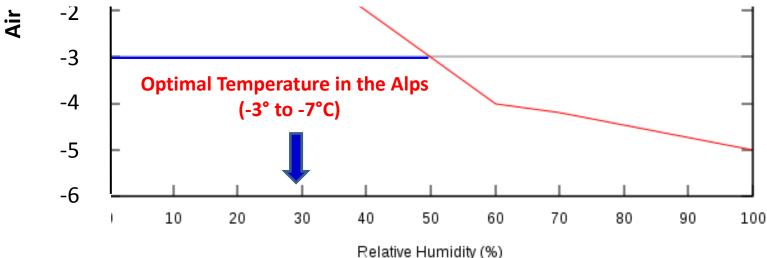


Relative Humidity (%)

Meteorological Limits for Artificial Snow Production



Only 50% chance of finding 3 consecutive snowmaking days at altitudes of 600-1000m (German and Austrian Alps)



Falk and de Jong 2015

Opening postponed (2011, 2013, 2014, 2015...)



Limits of artificial snow production in La Plagne, 23 November 2011

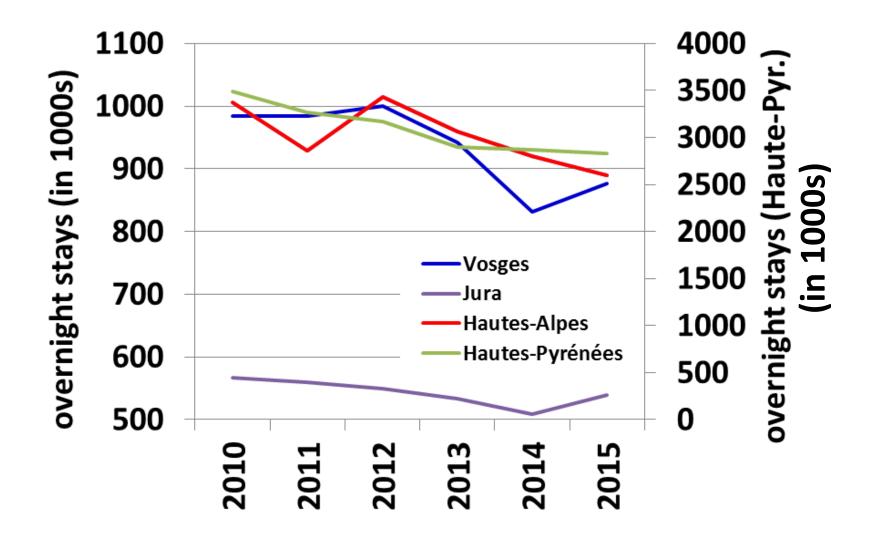
Earlier Closure

The season has to be closed 2 weeks earlier!

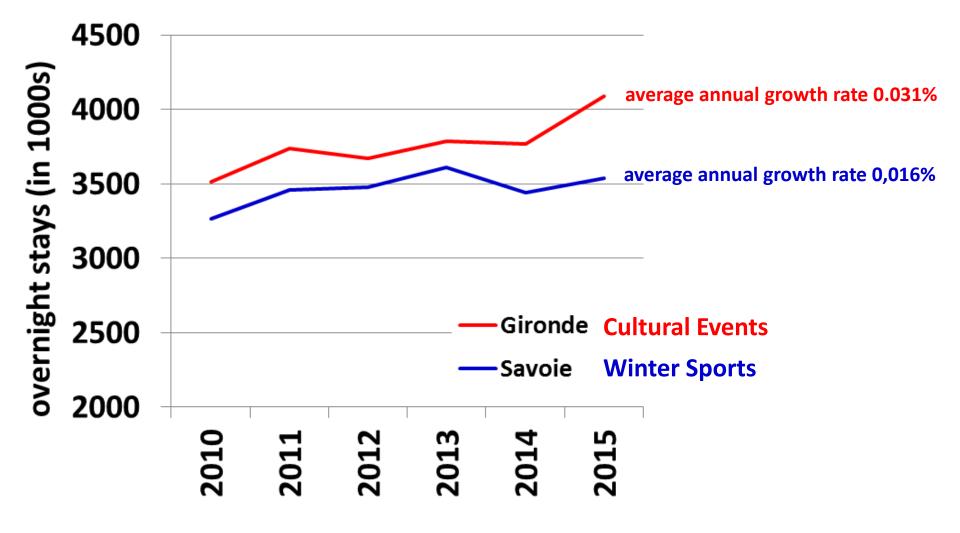


Artificial snow in Val Thorens, 18 April 2011

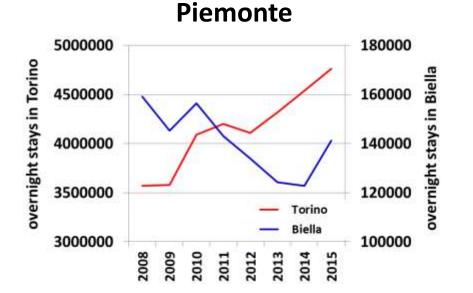
Evolution of Overnight Stays in France (Winter Tourism Destinations)



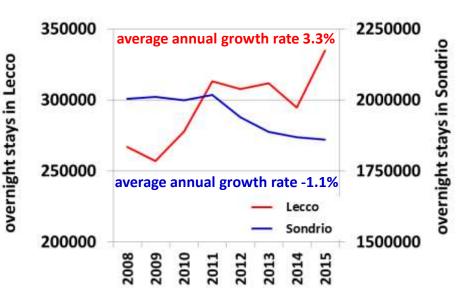
Evolution of Overnight Stays in France (Comparison of Winter and Summer Tourism Destinations)



Evolution of Overnight Stays in Italy

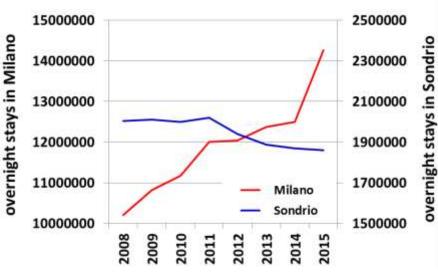


Lombardie



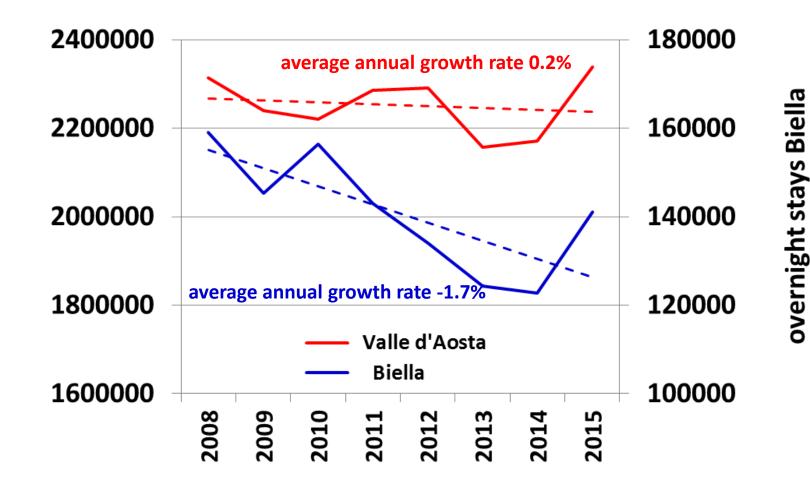






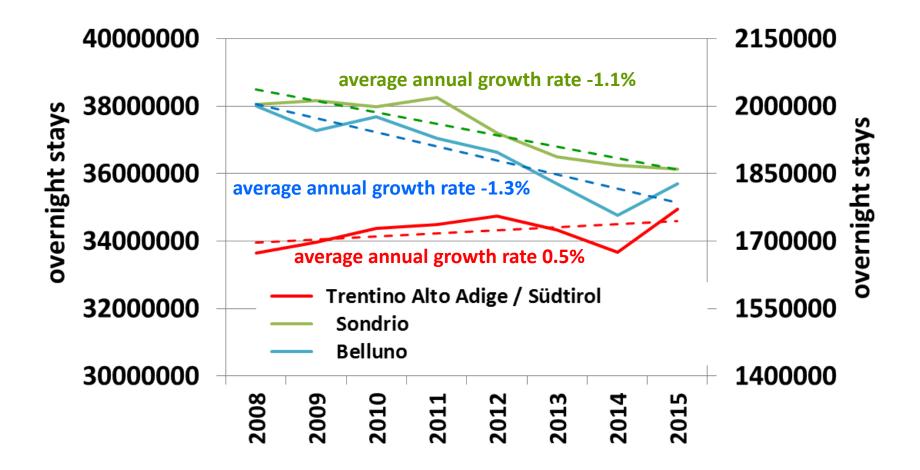
ISTAT 2016

Evolution of Overnight Stays in Italy (Winter Tourism Destinations in Val d'Aosta and Piemonte)



Evolution of Overnight Stays in Italy

(Winter Tourism Destinations in Lombardie, Veneto and Trentino)



Trends in Winter Sports

"Young practitioners consider winter sports (all activities) as an entertainment and tend to practice them occasionally."

Macchiavelli and Pozzi 2014

"Ski tourists are relatively old, city tourists are young."

Falk 2016

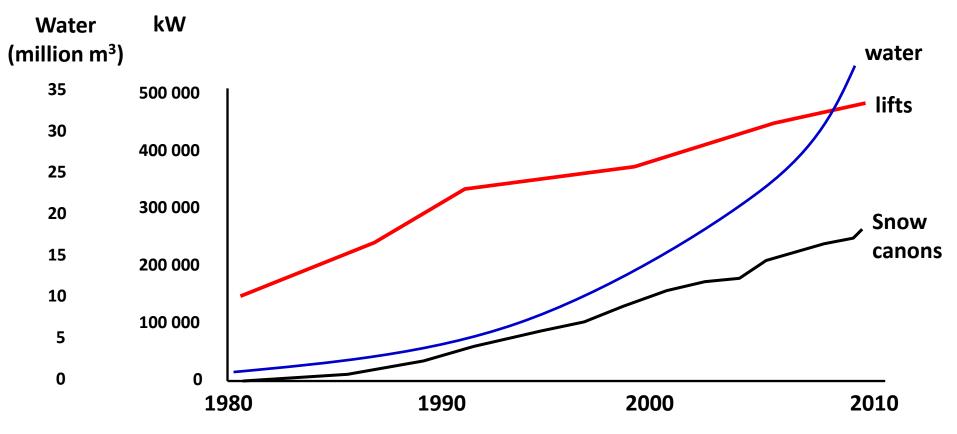
Trends in Winter Sports

"An ageing population, less interest in skiing among children and youth and changing tourism patterns will influence winter tourism demand in the future".

Macchiavelli and Pozzi 2014

2) How does winter tourism affect the environment and contribute to climate change?

Energy and Water used for Artificial Snow and Lifts (in France)



Brauneck Ski Area in Summer 2006, Bavaria

Value creation through public summer tourism

Foto Franz Speer 13.09.2006

Photo: Franz Speer

During Construction of Snowmaking Reservoir, 2012

After Construction, Summer 2013

Algae development

Photo: Franz Speer



Photo: de Jong

Value loss of public summer and winter tourism



IDE Snow Factory with 4 Cooling Towers (Zermatt, Switzerland)



Photo: Cordier 2011

Construction of New Water Reservoir (Sölden, Austria)



Water Reservoir "Panorma Lake" Sölden (2800 m near glacier, Austria)

"Snow Farming" - snow removal from Accumulation Zone (2003, Rettenbachferner, Austria)

lmage © 2018 Geolmage Austria

Pollution from Oil and Soot from Snow Grooms

linege © 2018 Geolinege Austria

Water Scarcity



Level of Lake Davos (11th October 2009)

Level of Lake Davos (8th February 2010)

28 m lowering of lake level in winter due to water abstraction for snowmaking

Fish killed during Low Flows in the R. Loisach (Bavaria) (due to water overconsumption for snowmaking in the Ehrwald ski resort)



Society of Ecological Research

Photo: Doering

"Black List" of Illegal Water Use for Snowmaking (due to increased water demand for > in ski runs and > seasonal frequency of snowmaking)

- St. Johann, Pongau, Austria 2008
- Kleine Scheidegg-Männlichen, Berner Oberland, Switzerland
- many more unpublished.....



"Black List" of Drinking Water Scarcity in Ski Resorts (due to water over-use for snowmaking)

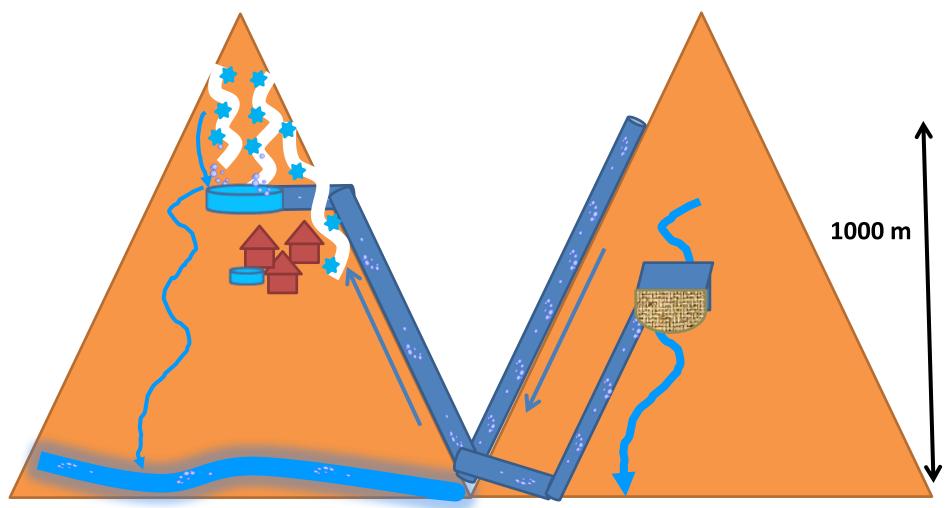
- Les Menuires ca. 2008
- Les Gets 2006
- Pralognan-la-Vanoise ca. 2011
- many more unpublished.....



Water Pollution



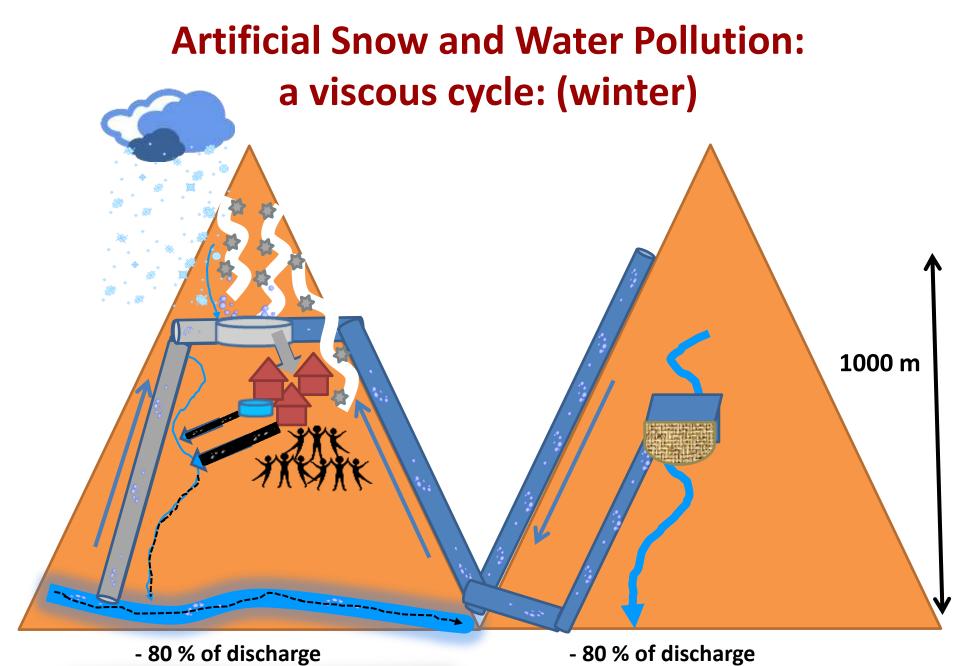
Artificial Snow and Water Pollution: a viscous cycle: (autumn)



- 10 % of discharge

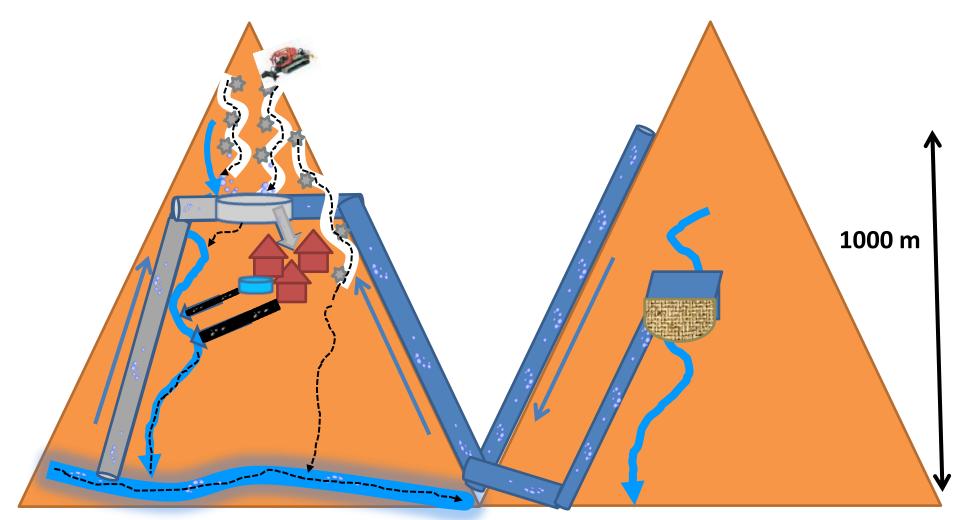
- 20 % of discharge

de Jong 2011



de Jong 2011

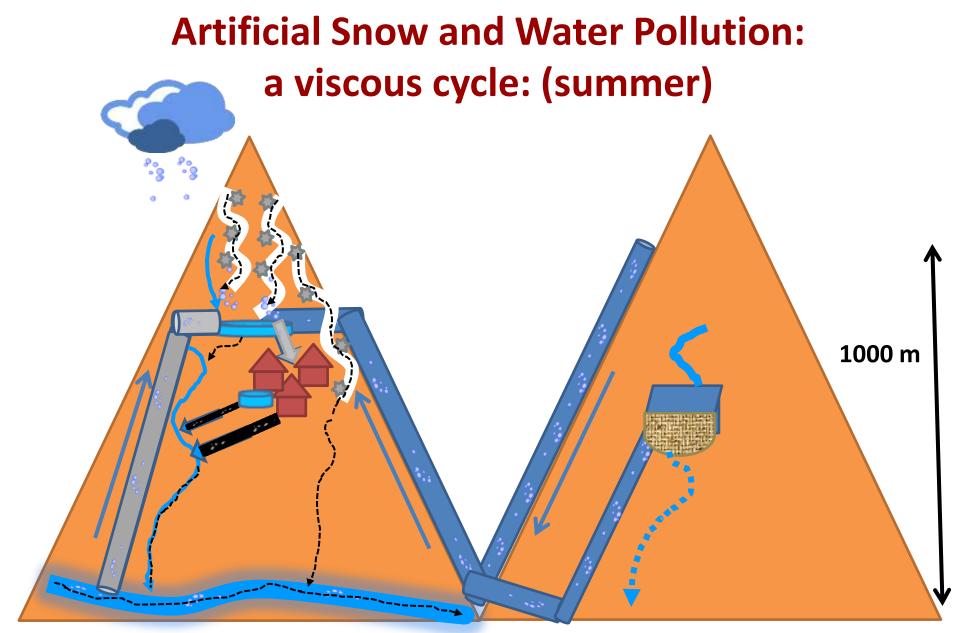
Artificial Snow and Water Pollution: a viscous cycle: (spring)



+ 30 % increase in flood peaks

+ 30 % increase in sediment transport

de Jong 2011



+ 30 % increase in flood peaks

+ 30 % increase in sediment transport

de Jong 2011

Water Pollution due to Artificiel Snow and Ski Resorts



Water Samples below Les Menuires Ski Resort

EU Limit for Drinking Water: 0 E. Coli / 100 ml

E. Coli / 100 ml

16 November 2014

14 December 2014

8 March 2015

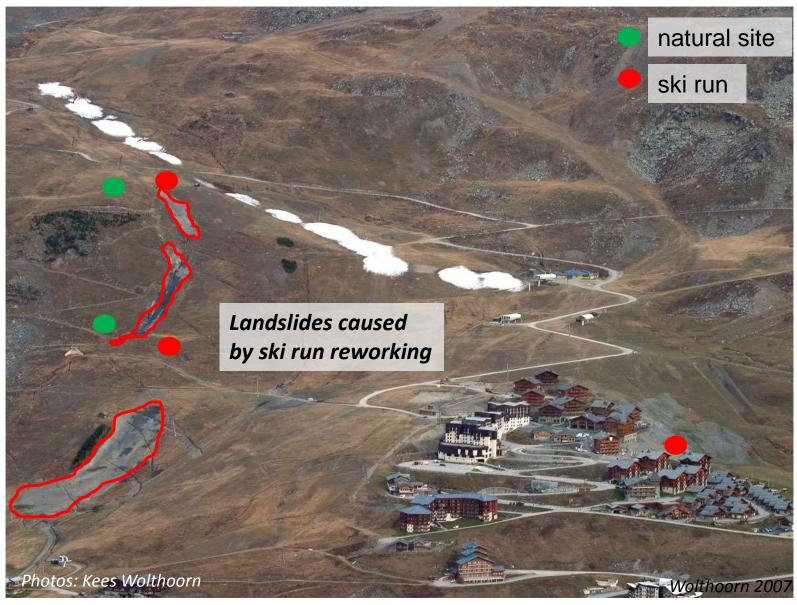
221

3133

6567

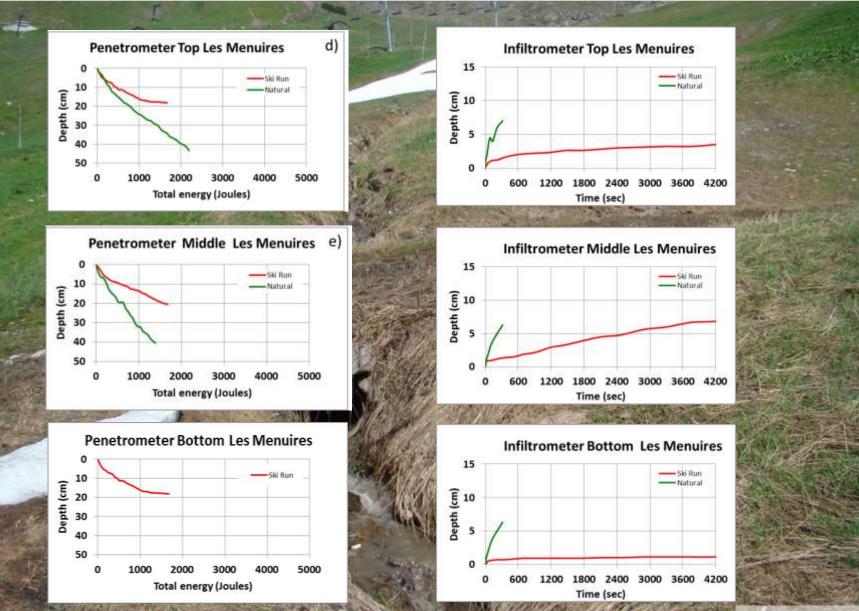


Soil compaction measurements at Les Menuires



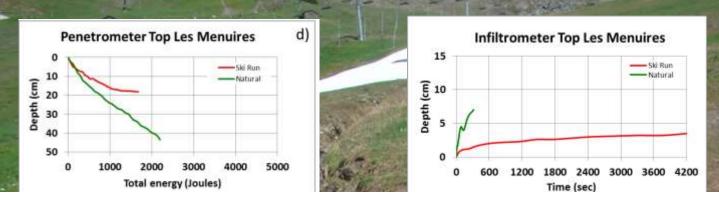
Les Menuires, 1900 – 2100m

Permeability and Soil Compaction at Les Menuires

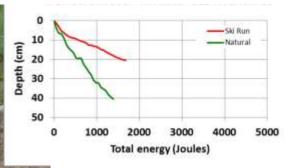


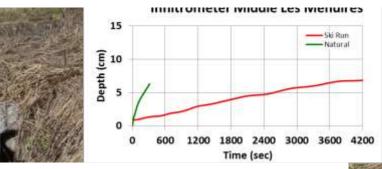
de Jong et al 2014

Permeability and Soil Compaction at Les Menuires

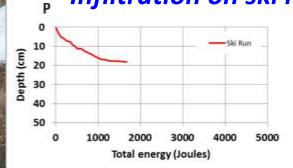


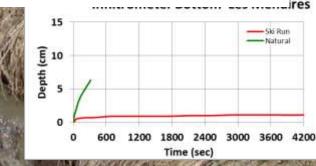
Soils on ski runs become impermeable at a depth of 20 cm





Infiltration on ski runs takes 5 - 20 times longer





Drinking Water Contamination in Chamrousse (a catchment-wide affair)



Drinking water unusable for 4 days in 6 communes / hamlets!

St. Martin d'Uriage (Villeneuve et Replat)

Grenoble



 \odot

Brié-et-Angonnes



Poisat





Image © 2016 DigitalGlobe

Date des images stallite : 25/2/2015 45007/46 02"N 5040/01 70"E 616y 400 m attitude 0.21 km

Goog

Violent Storms and Maintenance Works on Ski Runs caused Excessive Erosion and Debris Flows



Chamrousse Ski Resort near Grenoble, Isere, French Alps

But Plans are to go Higher (planned extension of Chamrousse to 2440m)

Image © 2016 DigitalGlobe

2003

Google earth

"Black List" of Drinking Water Contamination in / below Ski Resorts (mainly due to coli bacteria, diesel or suspended sediment)

- Chamrousse, France, 25th July 2016
- Villard-de-Lans, France ca. 2013
- Fiss, Austria, 22 February 2012
- Font d'Urle, France 2006
- Peisey-Nancroix, Les Arcs, France 2003
- Schladming, Austria
- Les Menuires, France
- many more unpublished.....



Excessive Water Introduction by Artificial Snow (Kronplatz, Dolomites, Italy)

Geology: crystalline base with quartziferous phyllites

Water from Burst Pipeline infiltrates unnoticed into Slope (Cianross, Kronplatz, Dolomites, April 2006)



www.funiforum.org

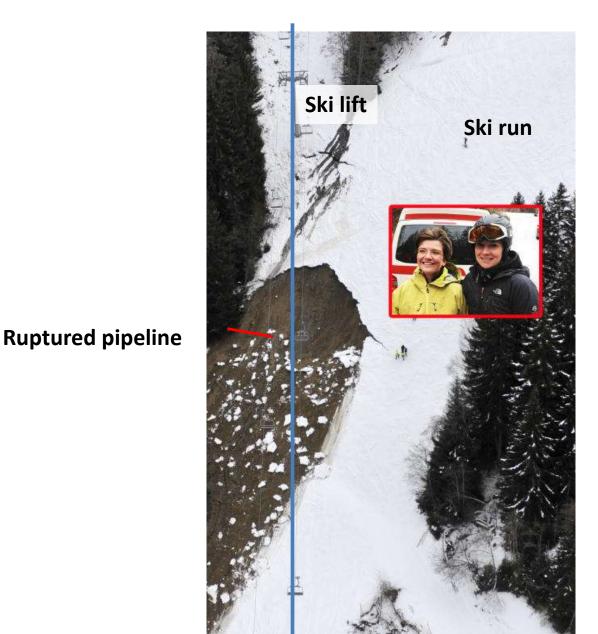
Landslide triggered by saturated slope (Cianross, Kronplatz, Dolomites, April 2006)

www.funiforum.org

Destruction of New Ski Lift (2 days after end of season!)

www.funiforum.org

Another landslide triggered by Ruptured Pipeline (Rifenalbahn, Zams, Tyrol, Austria, January 2013)



The landslide damaged the electricity line so the lift stopped, trapping the passengers

Foto: © APA/Zoomtirol

"Black List" of Slope Modifications in Ski Resorts (due to water over-use for snowmaking)

In Fügen, (Zillertal, near Innsbruck) Austria it is planned to invest a couple of million Euros to make the ski slope a few degrees steeper in order to cover them by less artificial snow (and decrease direct sun radiation)



3) What can we do to minimize our influence on the environment?

The Future of Winter Sports

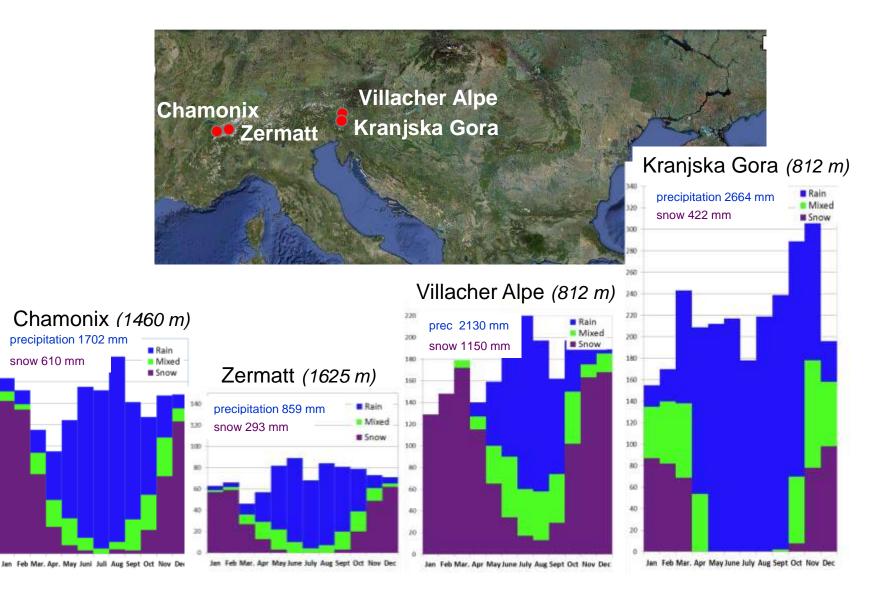
(as seen by the Head of MCI Tourism Business Studies, Innsbruck)



Snow Shoe Tour



Comparison of Precipitation across the Alps



after Kotlyakov 1997

When Stakeholders take their Stakes

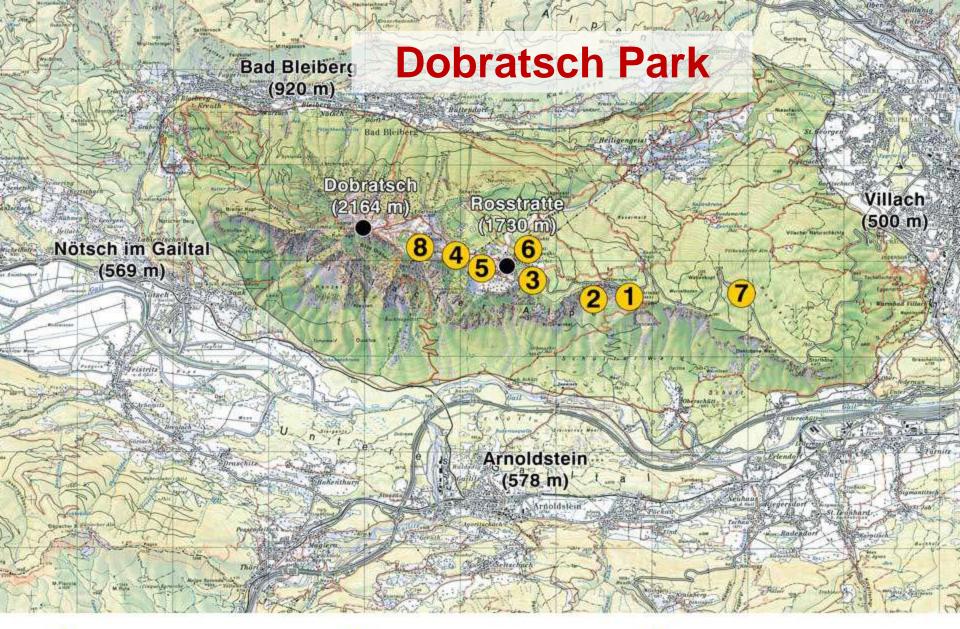
into their own Hands



The Creation of the Natural Park Dobratsch

by a citizen initiative





- Alpengarten Villacher Alpe
 Aussichtsplattform
 Die Vogelwelt des Naturrparks
- Geolehrpfad Rosstratte
 Kinderspielplatz Rosstratte
 Relaxliegen

Villacher Alpenstraße 10er Aussichtsberg

Partner Enterprises – Specialties from the Park

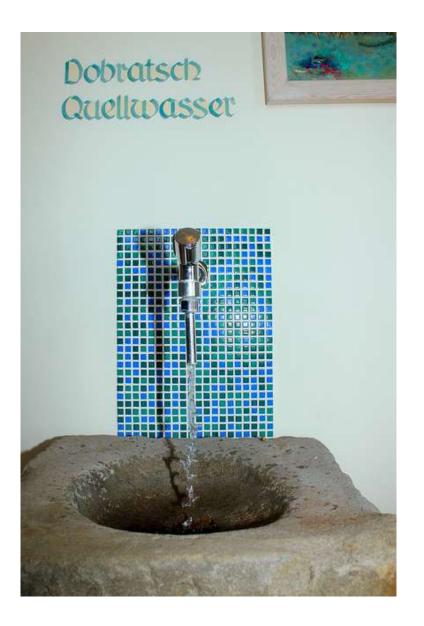




Honey

Meat products

Dobratsch Spring Water Protection for Villach



Planneralm, Austria Ski Area without Artificial Snow



Advantages

- people do not ask for artificial snow
- people love the feeling of natural snow
- energy and water savings contribute to green economy and climate change mitigation

Disadvantages

- cannot open in the pre-season
- cannot open when no snow
- no financial support

Photo: Planneralm

Stakeholder Discussions in Brauneck Ski Area (Bavaria)

h

Parliamentary Hearing on Sudelfeld

(Bavarian Government, 2013)

udia Star

Awareness Raising through the Media



MDR 20.01.2014

ARTE Yourope 24.01.2015





France5 11.02.2014

BR 09.02.2014

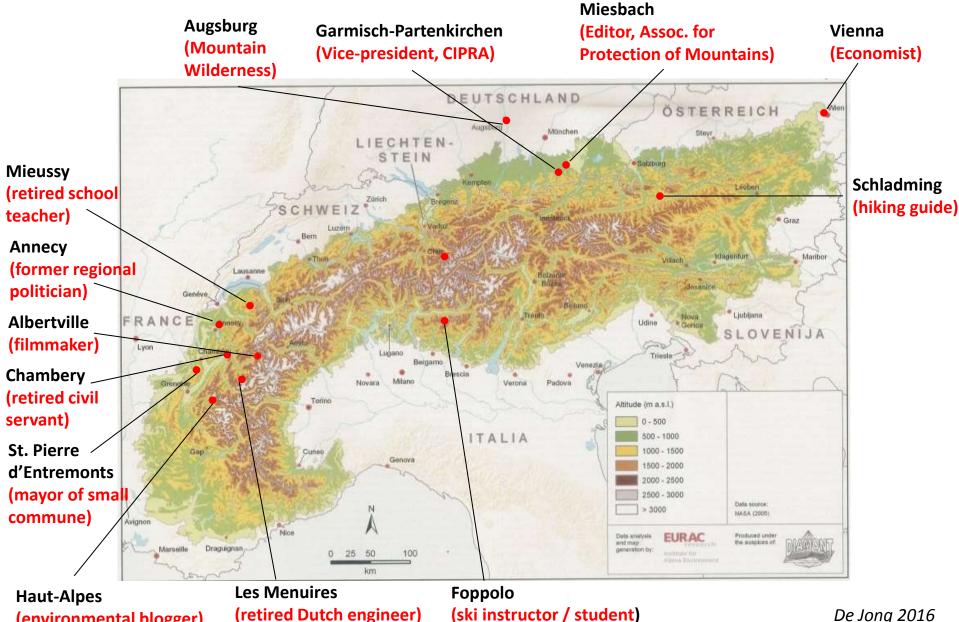
Simple Monitoring on Ski Runs for Stakeholders



ARTE Documentary 01.03.2016



Regular Stakeholders Feedback on Environmental Issues



(environmental blogger)

De Jong 2016

CONCLUSIONS

Sustainable winter tourism means living with altitude, topography and the seasons

Winter tourism should be compatible with summer tourism

Climate Change / Mountain Witnesses should provide information on regular basis and interconnect