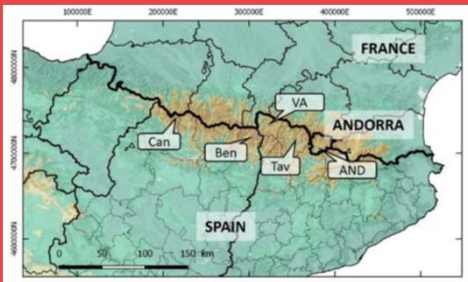


AVALANCHE TERRAIN EXPOSURE SCALE MAPPING IN THE PYRENEES: AN EXPANDING PROJECT

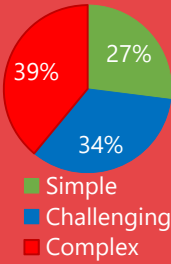
Montse Bacardit^{1*}, Sara Orgué², Ivan Moner¹, Jordi Gavaldà¹, Aina Margalef³, Marc Pons³, Gerard Olm², Rocío Hurtado², Pablo Huelin², Albert Piqué², Luis Masgrau⁴, Miguel Ángel Clavero⁵

¹Consell Generau d'Aran (CGA), Val d'Aran, Spain; ²Freelance Avalanche Technician, Pyrenees; ³Centre d'Estudis de la Neu i la Muntanya d'Andorra (CENMA-IEA), Andorra; ⁴Campaña Montaña Segura, Federación Aragonesa de Montañismo (FAM), Spain; ⁵Campaña Montaña Segura, Gobierno de Aragón (DGA), Aragón, Spain;

ATES zoning in the Pyrenees



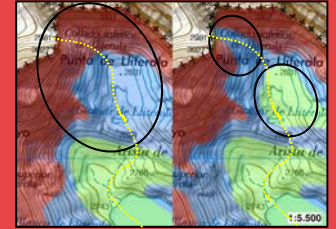
910 km²
Total terrain zoned



Methodology

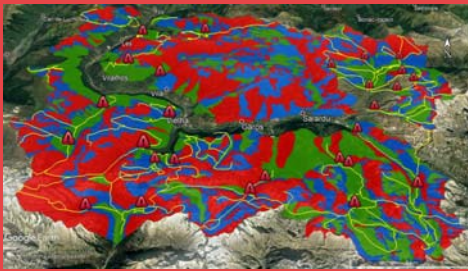
- * **Zoning Model** (Campbell & Gould, 2014) used instead of the Technical Model v1.04 (Statham, 2006)
- * **Polygon boundaries and polygon scale** demand expertise and is tremendous **subjective**
- * **Individual survey to professionals** involved in the ATEs zoning in the Pyrenees: **75% is objective** and 25% is subjective; **85-95% is consistent** among individuals of the same mapping team (7% of the zoned terrain estimated roughly)

Approach: adjusting Polygon Scale with Polygon Function

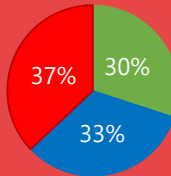


Example in Lliterola valley, Benasque

Val d'Aran – Region

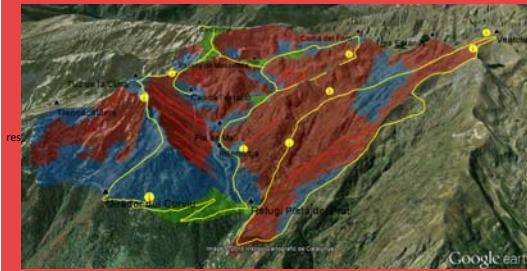


563 km²
Backcountry & Sidecountry

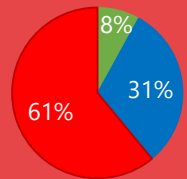


First ATEs site in the Pyrenees in 2011. ATEs zoning fully completed and ready for the 2018-19 season

Tavascan – Ski center



8 km²
Sidecountry

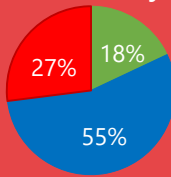


Local ski center with large sidecountry terrain. ATEs ratings applied for zones and itineraries

Canfranc - Valley



18 km²
Backcountry & Sidecountry

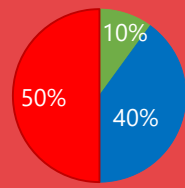


ATES ratings around Astún and Candanchú ski centers. An automatic GIS algorithm has been used to control the implicit subjectivity of the Zoning Model

Benasque – Mountain Huts

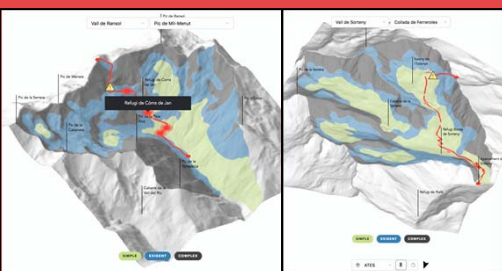


127 km²
Backcountry

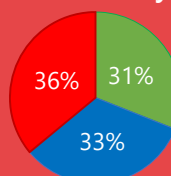


Aragonese Mountain Federation (FAM) and Government of Aragón promote ATEs mapping accessing and around mountain huts. On-going project

Andorra - Country



195 km²
Backcountry & Sidecountry



Andorran government promotes ATEs mapping in all the valleys of the country. On-going project

Communication

- * On-line and downloadable maps
- * Panels in the trailheads
- * Terrain class concepts used in travel advices of local avalanche advisories (Aran Avalanche Center and Alurte)
- * ATEs and Avaluator™ Trip Planner included in avalanche training programs by ACNA and EDNA

Outlook

- * ATEs zoning **rapidly spreading** out in the Pyrenees, as part of **safety projects** promoted by **governments, ski centers, mountaineering federations and natural parks**
- * **Need for consensus** on the methodology to produce **objective, consistent and uniform ATEs maps across sites and professionals involved**