THE WATER CYCLE
IN THE IMLIL VALLEY

OVERVIEW

The water cycle is a compulsory part of the new AS/A level specifications.
The Imlil valley offers opportunities to study some local scale aspects of the water cycle (**Figure 3**)

Water cycle in the Imlil valley

Precipitation

Imlil experiences a semi-arid mountainous climate. Significant winter snowfall is an important store of water. This will often be released as a rapid transfer during the spring melt, from about March/April. Heavy rainstorms can occur throughout the year and may combine with spring snow melt to create significant overland flow and potential flooding (1995). In March 2018 a flash flood in one of the tributary valleys swept away a stretch of the main road between Imlil and Asni cutting communications for a day (**Figure 1**).

Figure 1. Reconstruction of Imlil Asni road following the flash flood (March 2018)

Interception

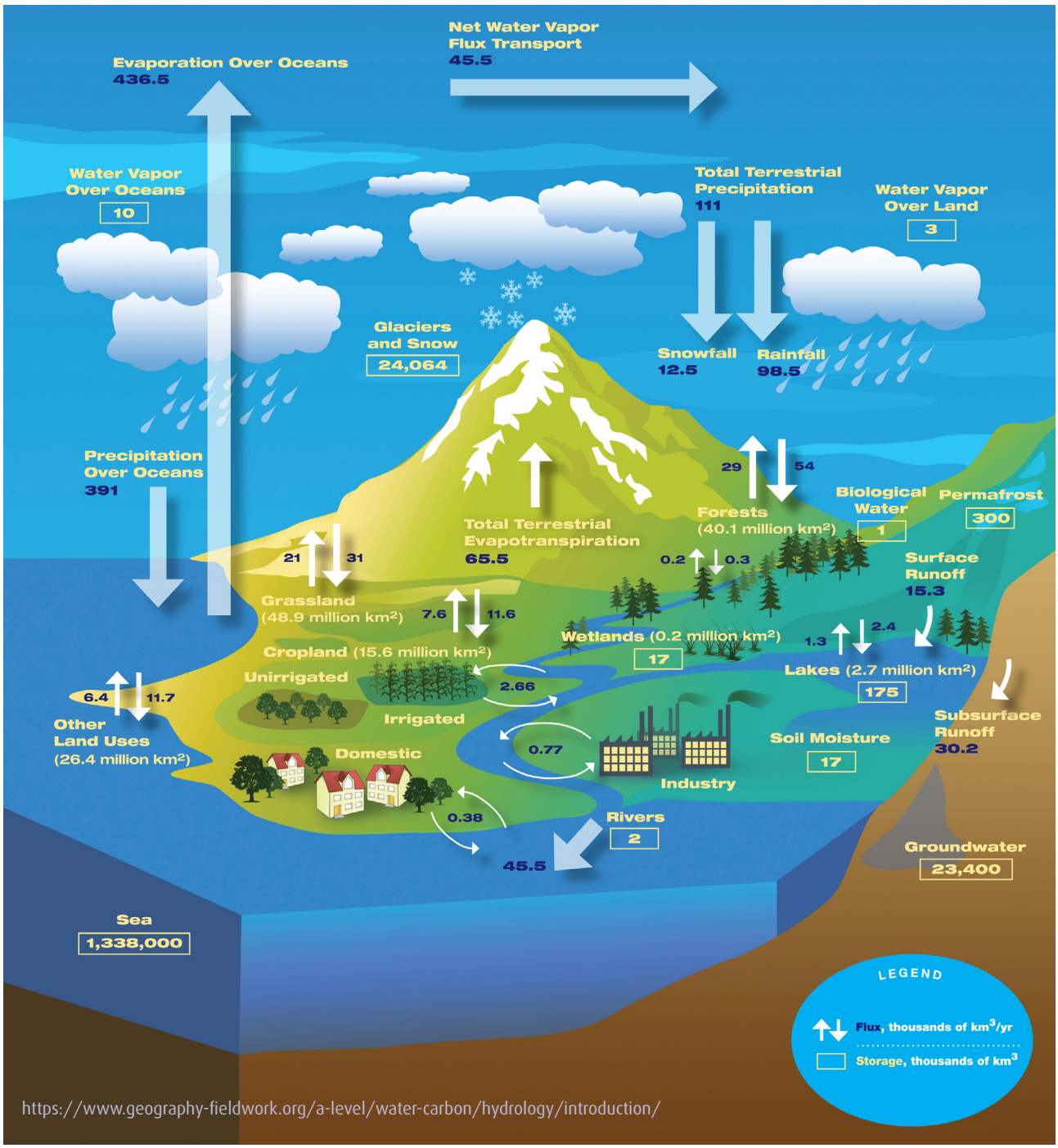
Tree coverage is generally rather sparse, with some pine trees on the upper slopes and fruit/walnut trees at lower elevations and in the valley bottom. In the winter, interception is minimal with the lack of leaves on most trees. There is some grass/crop coverage in the valley especially during the summer. Overall, there is limited interception and subsequent evapo-transpiration. **Figure 2** shows the typical characteristics of the hillslopes surrounding Imlil.

Figure 2. Bare hillsides and limited vegetation cover on slopes surrounding Imlil (view from the Kasbah looking NE as in field sketch Figure 2)

Evapo-transpiration

Evapo-transpiration is limited due to the sparse vegetation cover. In the summer, higher temperatures will encourage evaporation from surfaces (rooftops, roads, etc).

Figure 3. The water cycle



Infiltration

Infiltration will be limited on the upper slopes which are predominantly bare rock with limited soil development. On the lower slopes, scree will enable some water to drain rapidly through broken rock fragments. Soil development on the lower slopes and valley floor will enable some infiltration to take place.

Overland flow

This is likely to be a significant form of water transfer due to the steep slopes, bare rock outcrops, impermeable rocks, lack of vegetation and limited infiltration. There are numerous 'dry' channels on the mountain slopes suggesting the importance of overland flow in response to rainfall events. The significance of overland flow in the area accounts for the high flood risk (1995, 2018).

Throughflow/baseflow

Due to the limited development of soils on the higher slopes, throughflow will be very limited here. At lower elevations, there will be some throughflow especially where coarse, angular rock debris has accumulated. Baseflow will be very limited due to the presence of predominantly impermeable rocks.

Discharge

Discharge will be variable throughout the year and will be subject to peaks (heavy rainfall, snow melt) and troughs (periods of drought). The presence of braided channels suggests variability of discharge together with large quantities of deposited sediment (**Figure 4**).

Figure 4. Braiding and channel diversion for irrigation affects discharge and water transfers in the sediment choked valley floor

Factors affecting the water cycle

Relief/geology

Much of the area is underlain by impermeable igneous rocks which account for the steep slopes and jagged peaks that comprise this spectacular mountain landscape. Water will be transferred rapidly by overland flow following heavy rainfall or snow melt.

Vegetation

Traditional trees such as walnuts and fruit trees provide some vegetation cover particularly at lower elevations and in the valley bottom. The absence of leaves in winter reduces the effectiveness of these trees in the interception of precipitation. At higher elevations patchy coniferous (pine) trees plantations provide some interception throughout the year. Grass and some cereal crops on the valley floor will intercept precipitation particularly in the summer.

Urban development

Buildings (mostly flat-roofed) and roads create impermeable surfaces and will reduce infiltration and encourage overland flow. This will increase the flood risk. Several road developments have taken place in recent years thereby increasing potential overland flow.

Water management

Water is managed in the Imlil valley to provide drinking water from springs and water for irrigation. Concrete channels have been constructed on the valley sides to transfer water to the terraces and gardens, watering the walnut and fruit trees. On the valley floor, stone walls have been used to divert water into small fields to water fruit trees, grazing pasture and food crops. **Figure 5** shows various human interventions in the valley floor, with small diversion canals used for irrigation and the creation of small fields for crops and fruit trees.

Figure 5. Human management in the river valley

Photos: Simon Ross