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Abstract : The Kali Gandaki valley holds the easternmost population of *Cupressus torulosa*. The photo gallery travels on an upstream journey on the east bank of the river from Kokhethanti to the neighbourhood of Jomson. Apart from the cypress, species of the genera *Pinus*, *Picea*, *Tsuga* and *Taxus* are encountered.

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Cover photo: Mature *Cupressus torulosa* next to a path, Kali Gandaki valley. 2550 m altitude.
2019.03.16. © A. Golinelli.

Voyage through conifer landscape The Kali Gandaki valley, Mustang, Nepal

Photo gallery

A photo gallery of the natural population of *Cupressus torulosa* growing in the Kali Gandaki valley, Lower Mustang, Nepal. Over the 6 km stretch from Tukuche in the northeast, to the bend near Kokhethanti, *C. torulosa* forms pure stands or mixes with other conifers, mostly *Pinus wallichiana*, but also locally *Tsuga dumosa*, *Picea smithiana*, and *Taxus contorta*.

C. torulosa thrives in the sandy, often flood-disturbed river banks here, but also on the steep cliffs above it, on both sides of the river. Downstream, and higher up on the slopes, *P. wallichiana* takes over. At even higher altitude, other species such as *Abies spectabilis* (not shown here) appear. Upstream, the Kali Gandaki valley becomes even drier and *C. torulosa* is not present.

Photos taken in mid-March 2019. All photos © A. Golinelli.

Fig. 1: On the south bank of the Kali Gandaki river, a *Cupressus torulosa* dominated stand with some *Pinus wallichiana*. *C. torulosa* often grows to a fairly tall height with a narrowly conical habit (centre right) until it becomes somewhat denser and wider.





Fig. 2: *Cupressus torulosa*, Kali Gandaki valley, Nepal.



Fig. 3: *Pinus wallichiana*, Kali Gandaki valley. Dhaulagiri in the background.



Fig. 4: *C. torulosa* and *P. wallichiana*, Kali Gandaki valley, Nepal.

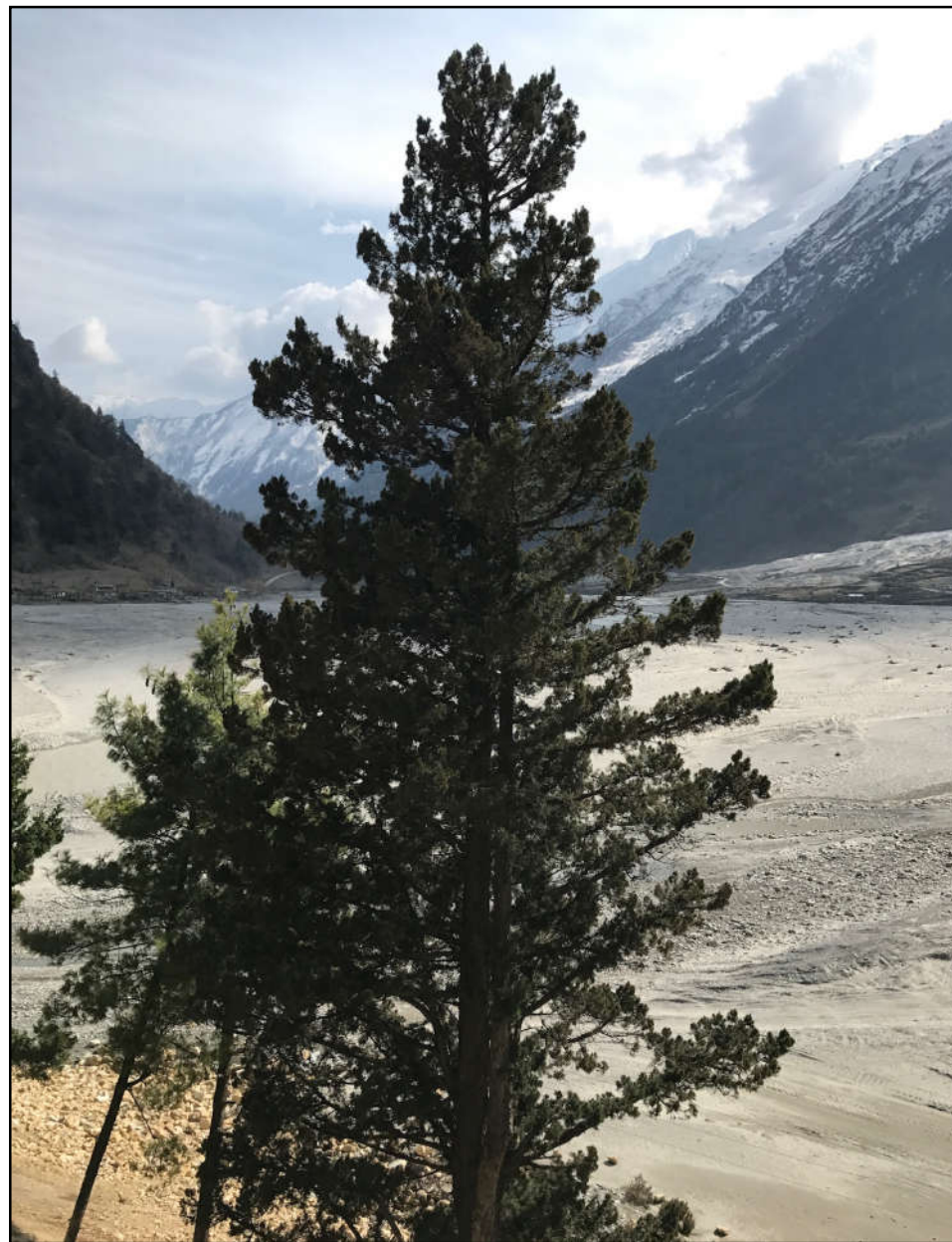


Fig. 5: *C. torulosa* and *P. wallichiana*, Kali Gandaki valley, Nepal.
Dhaulagiri massif in the background.



Fig. 6: *Cupressus torulosa*, foliage. Kali Gandaki valley, Nepal.



Fig. 7: Mixed *C. torulosa* and *P. wallichiana* forest, Kali Gandaki valley.



Fig. 8: *Cupressus torulosa*. Dhaulagiri in the background. 1097



Fig. 9: *Cupressus torulosa* is usually the dominant tree in its range close to the Kali Gandaki river. A few *Pinus wallichiana* share its habitat, but *C. torulosa* seems to be better adapted to the drier conditions. The road to Mustang was cut into the steep riverside and the rocks pushed on the trees, into the riverbed.

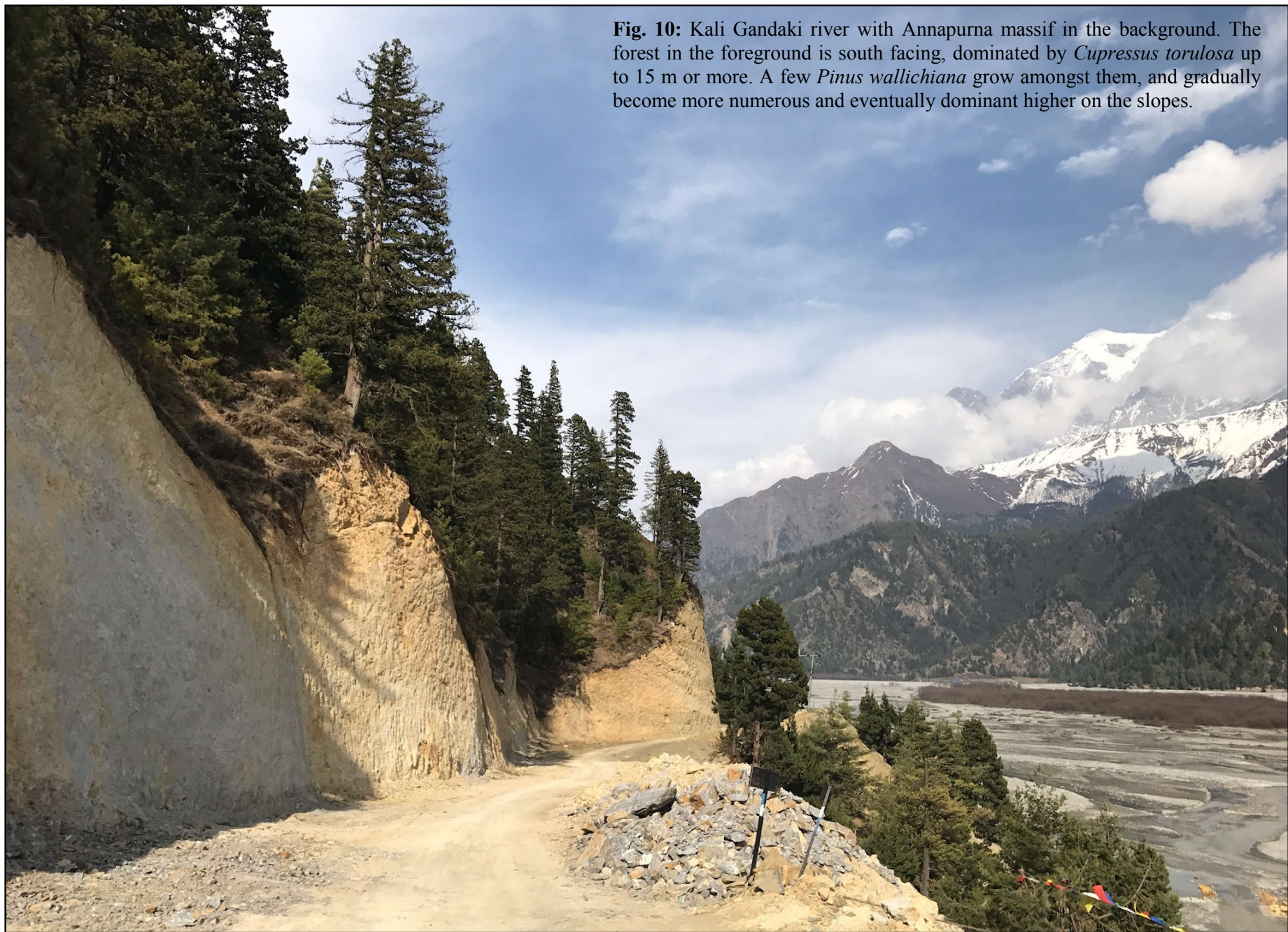


Fig. 10: Kali Gandaki river with Annapurna massif in the background. The forest in the foreground is south facing, dominated by *Cupressus torulosa* up to 15 m or more. A few *Pinus wallichiana* grow amongst them, and gradually become more numerous and eventually dominant higher on the slopes.



Fig. 11: Stand of *Taxus contorta*. On the upper centre of the picture, a *Tsuga dumosa* emerges. The *Taxus* population likely developed as an understory of more *Tsuga*, now felled.



Fig. 12: Mixed *Tsuga dumosa*–*Pinus wallichiana* stand with bamboo and *Taxus contorta*. On the other side of the Kali Gandaki (which at this point is suddenly becoming narrower), a *Cupressus*-dominated stand is visible.



Fig. 13: *Tsuga dumosa*. In many parts of the Himalaya, this species is capable of attaining gigantic proportions and living many centuries. Here, although it dominates the canopy locally, it is much shorter lived and rarely exceeds 15 metres.



Fig. 14: *Taxus contorta* and *Tsuga dumosa* in the foreground in a north facing forest dominated by *Cupressus torulosa*. On the other side of the Kali Gandaki river, the forest is also mostly composed of *C. torulosa*, with a few *Pinus wallichiana* (lighter green).



Fig. 15: *Tsuga dumosa*.



Fig. 16: *Taxus contorta*.

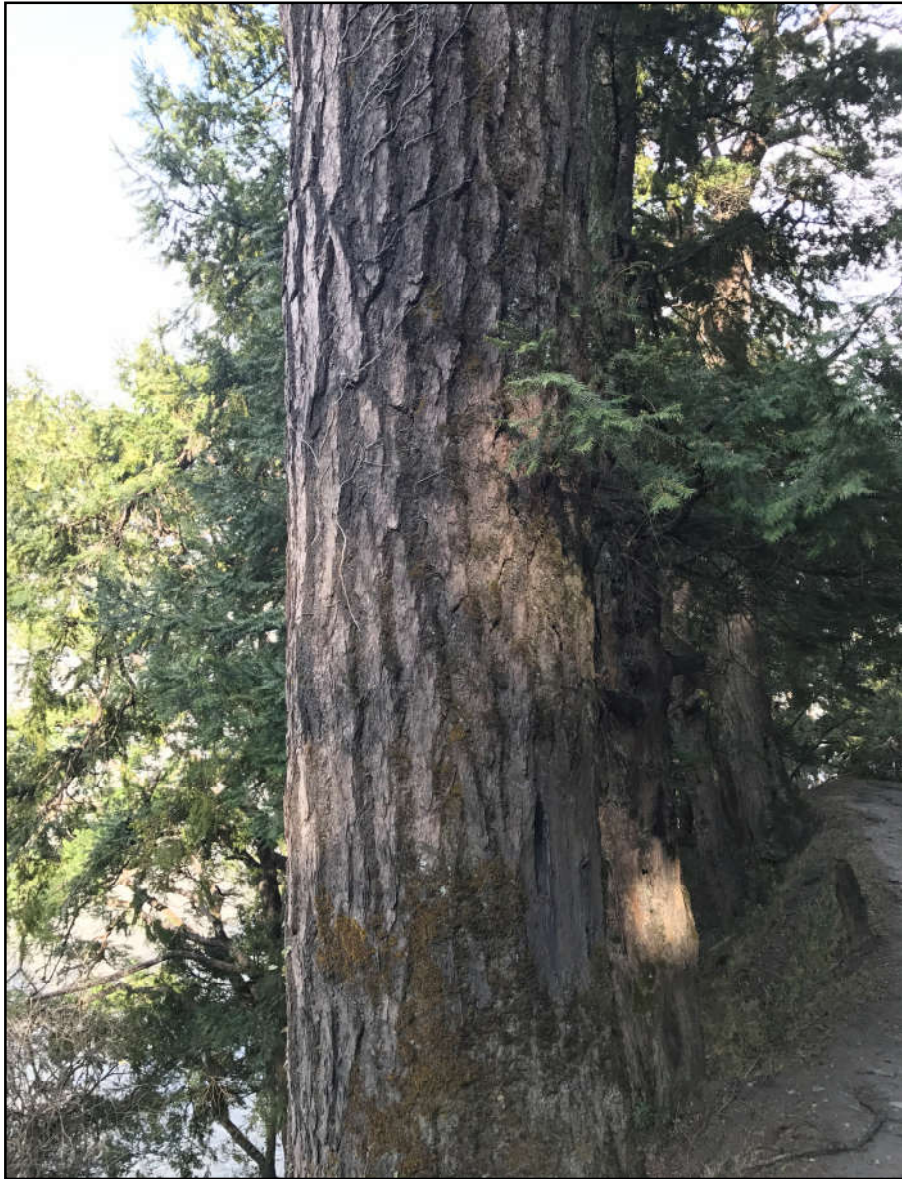
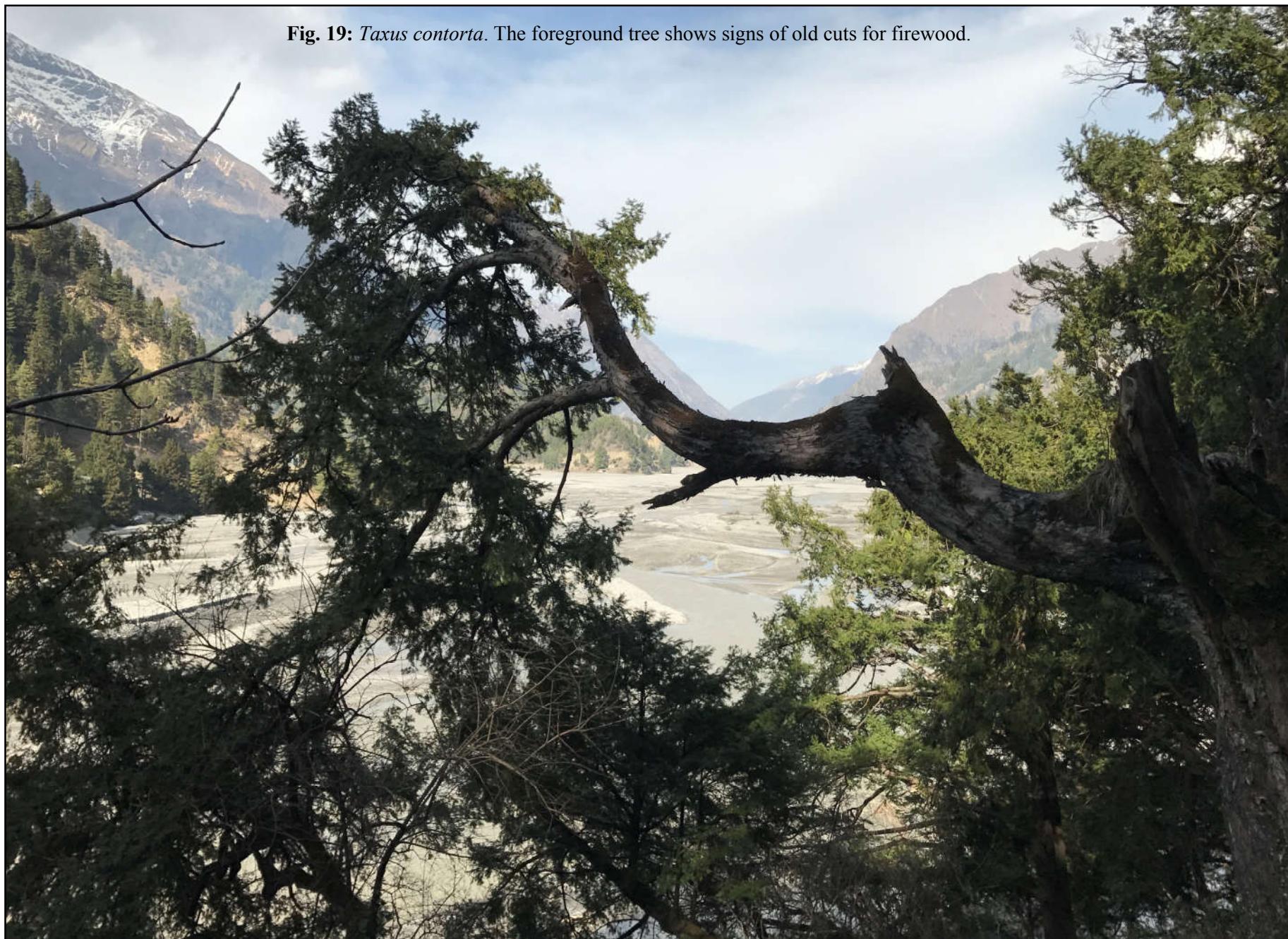


Fig. 17: *Tsuga dumosa* trunk, with *Taxus contorta* foliage visible behind.



Fig. 18: *Tsuga dumosa* (taller trees), with *Taxus contorta* in the centre and centre-right of the picture. North facing forest next to the Kali Gandaki river. 2530m.

Fig. 19: *Taxus contorta*. The foreground tree shows signs of old cuts for firewood.



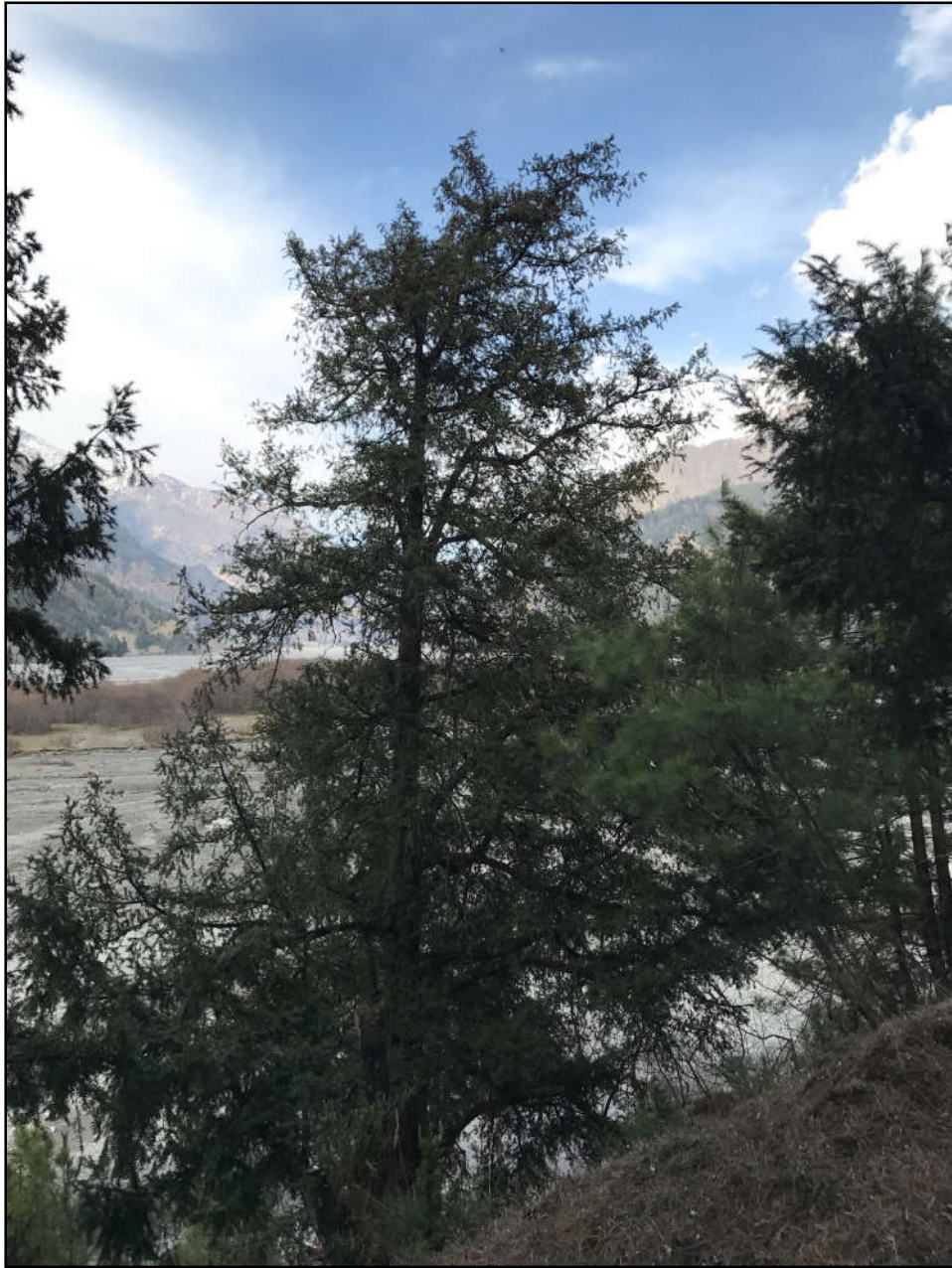


Fig. 20: *Taxus contorta*.



Fig. 21: *Taxus contorta*. Lower branches show signs of being cut, likely for firewood. *Picea smithiana* cones on the ground, lower right.



Fig. 22: *C. torulosa*, young specimen. Sheep herders pass through this forest and it shows signs of browsing.



Fig. 23: *Tsuga dumosa* seedling.



Fig. 24: North facing forest by the Kali Gandaki river. Dark green trees are *Cupressus torulosa*, lighter green trees are *Pinus wallichiana*. *Taxus contorta* is also present locally, as an understory tree. One specimen is visible, center-right of the picture, next to the river. Another one dried out and died after the ground it grew on fell onto the riverbed.



Fig. 25: *Cupressus torulosa*, cones.



Fig. 26: *Tsuga dumosa* among *P. wallichiana*.



Fig. 27: *P. wallichiana* stand with cut logs.



Fig. 28: *Cupressus torulosa* and *Pinus wallichiana*.



Fig. 29: *Cupressus torulosa* dominated forest on the bank of the Kali Gandaki. Dhaulagiri (8167m) in the background.



Fig. 30: *C. torulosa*, dead specimen in the riverbed of the Kali Gandaki. Shifting sand/mud dunes carried by the water can asphyxiate the young cypresses, a pioneer species that thrives in often disturbed ecological niches, but is also sometimes killed by it.



Fig. 31: View on the south of the Kali Gandaki river, near Kobang. The forest in the foreground is dominated by *C. torulosa*, with some tall, mature trees. Some trees have been pruned for firewood, leaving only the very top, or even no branches at all.



Fig. 32: Gandaki riverbed and bank, with *C. torulosa* dominated forest. Some trees on the very edge have succumbed, debarked by rocks carried by the river. The riverbed is littered with wood debris.



Fig. 33: Mixed *C.torulosa* (dark green) and *P. wallichiana* forest. The latter becomes dominant mid-way to the mountain ridge, before giving way to *Abies*. Between Larjung and Sauru, facing north.



Fig. 34: *Cupressus torulosa*. In the foreground, a young specimen with browsing damage. It managed to grow its main shoot tall enough to be out of the reach of the goats now. Above, a mature individual, multi-stemmed after it tilted down. In the background, mixed *C. torulosa* (dark green) and *Pinus wallichiana* (lighter green) forest.



Fig. 35: *Cupressus torulosa*, foliage and cones close-up.



Fig. 36: *C. torulosa*, foliage of a young tree.

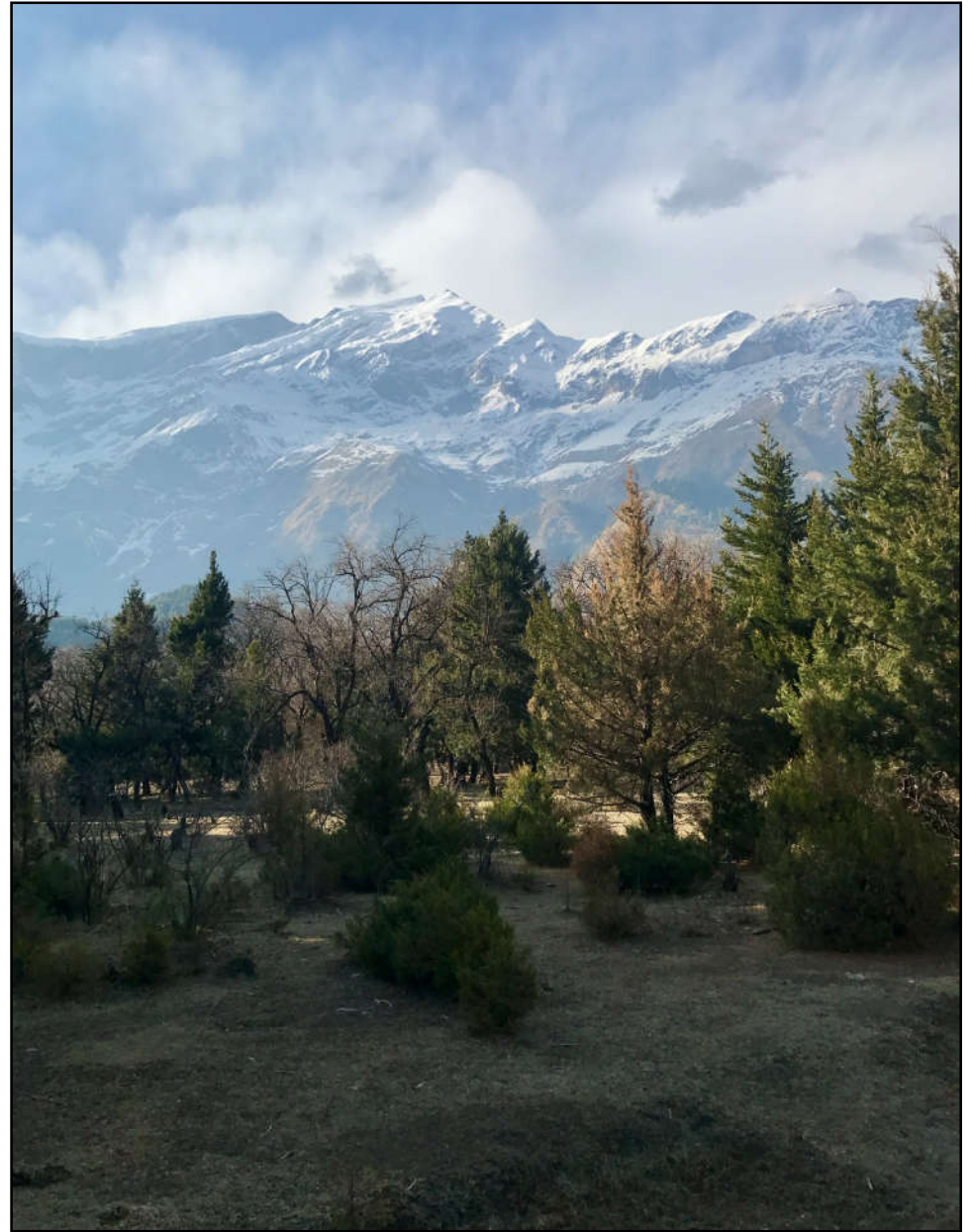


Fig. 37: *C. torulosa*, young trees on sandy ground close to the Kali Gandaki river, near Sauru. Dhaulagiri massif in the background.



Fig. 38: Shepherd hut, Sauru. *Cupressus torulosa* in the foreground, *Pinus wallichiana* dominated stand in the background, on flat, richer soil. Some *C. torulosa* among them. On the rocky cliffs (such as on the left of the picture), *C. torulosa* has almost no competition.



Fig. 39: Young specimens of *C. torulosa* and *P. wallichiana*, near Sauru, Mustang, Nepal.



Fig. 40: *Cupressus torulosa*, on and below cliffs near Sauru village.



Fig. 41: *C. torulosa*, young specimens. Dhaulagiri massif in the background.

Fig. 42: View of the Kali Gandaki river, looking northeast towards Mustang. Mixed *Cupressus torulosa* and *Pinus wallichiana* forest on the cliff abruptly falling into the river. *C. torulosa* is better suited than *P. wallichiana* to sandy places (e.g. the river bank) and the poorest cliff soil.

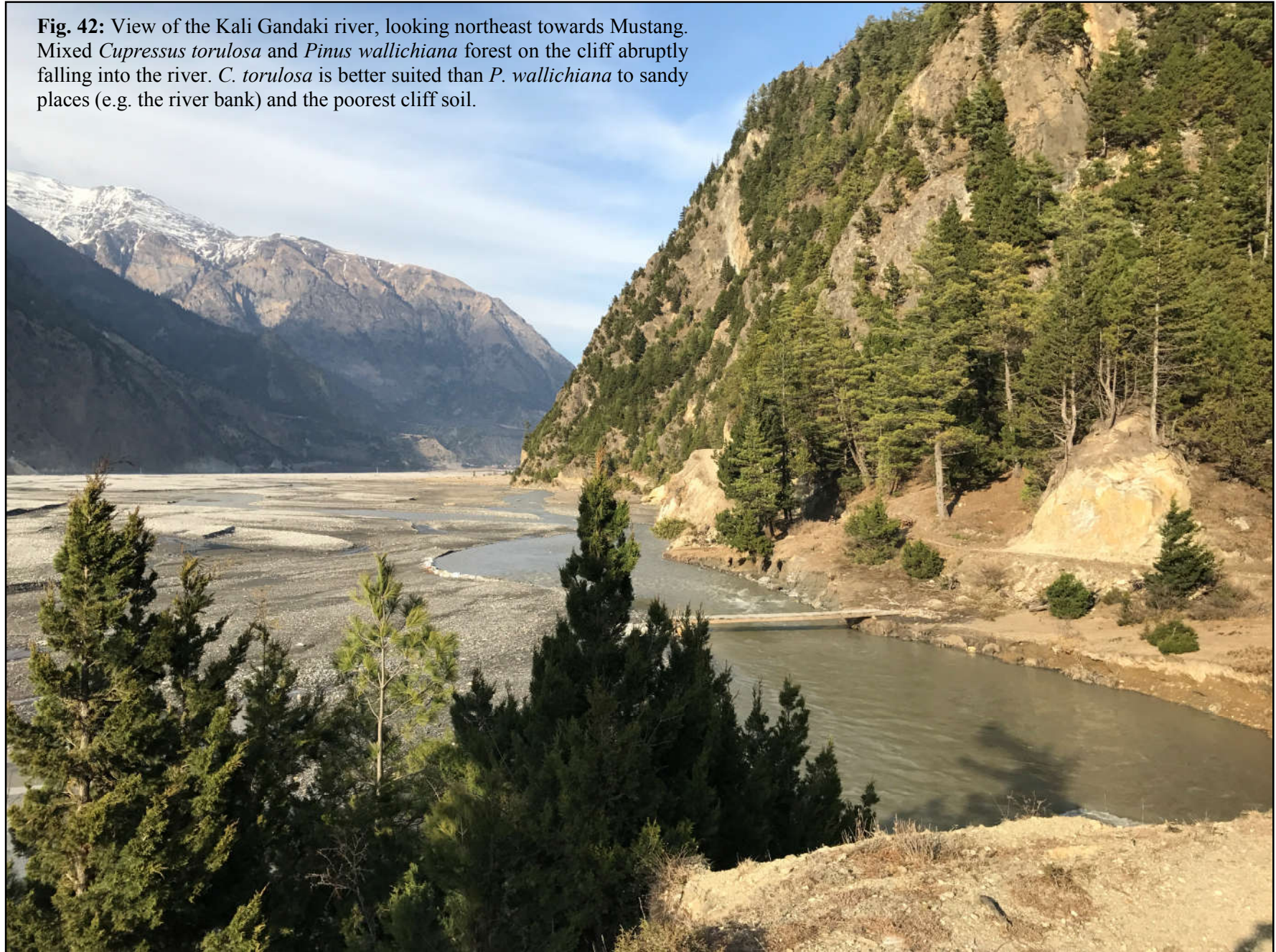




Fig. 43: *C. torulosa*, Kali Gandaki valley, Nepal.



Fig. 44: *C. torulosa* growing in the cliff of the Kali Gandaki river, near Sauru.



Fig. 45: *Cupressus torulosa* growing in the cliff of the Kali Gandaki river, near Sauru, Mustang, Nepal.

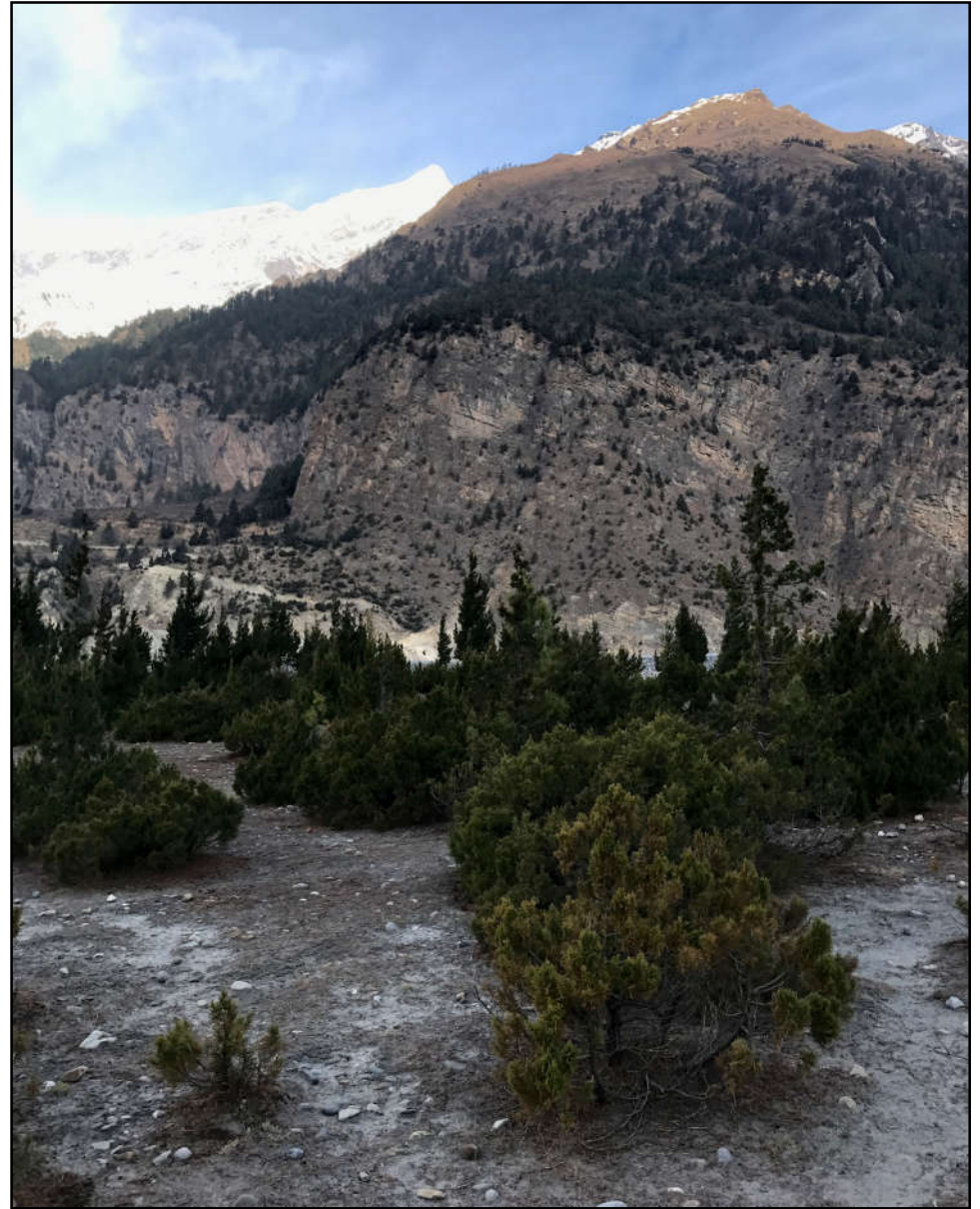


Fig. 46: *Cupressus torulosa* on sandy, former riverbed soil, grazed by cattle. In the background, *C. torulosa* grows in the steep cliff, but mixes with *Pinus wallichiana* on flatter ground above.



Fig. 47: *Cupressus torulosa* in the foreground. In the background, *C. torulosa* grows in the steep cliff, but mixes with *Pinus wallichiana* on flatter ground above.



Fig. 48: Kali Gandaki valley with snow-capped mountains in the background, and *Pinus wallichiana* shoots in the foreground. The river is wide here, divided in the dry season into a multitude of ever-changing channels.



Fig. 49: *Cupressus torulosa*, strong apical growth of a young specimen.

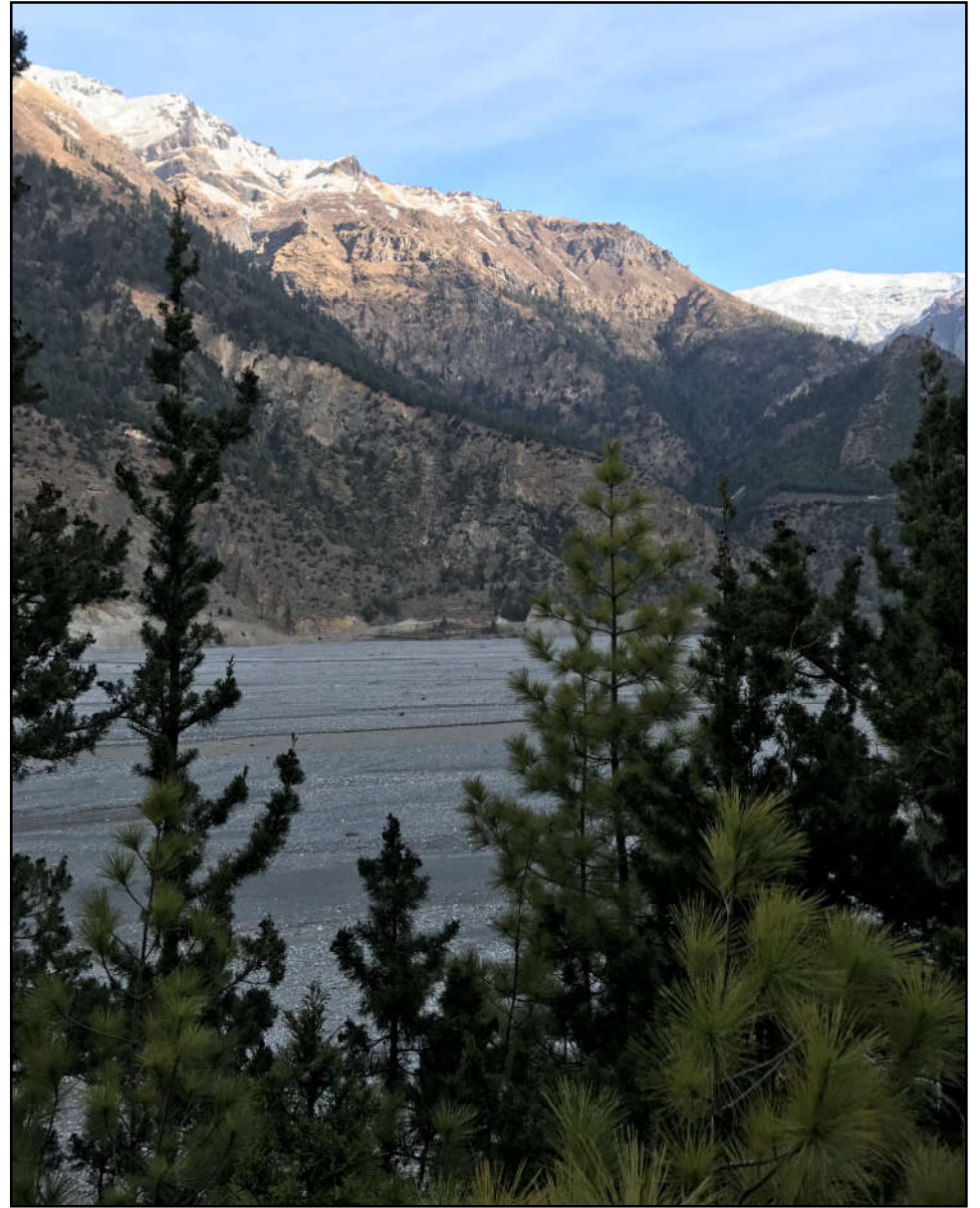


Fig. 50: Kali Gandaki river, with *Pinus wallichiana*–*Cupressus torulosa* forest on both sides. In the foreground, some young *C. torulosa* have a very narrow habit. At this age, getting taller is important to survival.

Map 1: Kali Gandaki river in lower Mustang, Nepal

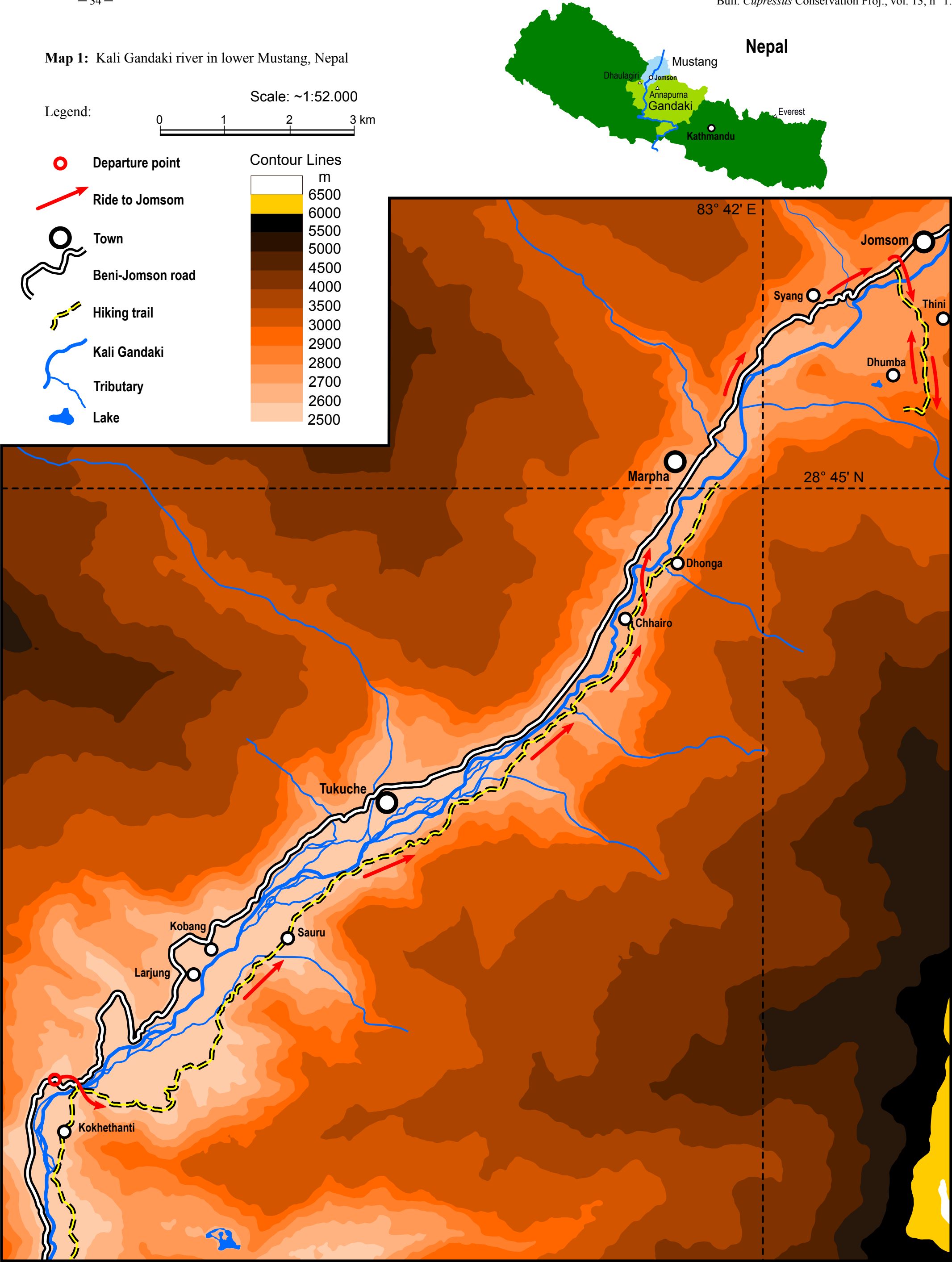




Fig 51: Mixed *Cupressus torulosa* and *Pinus wallichiana*.



Fig 52: Mixed *Cupressus torulosa* and *Pinus wallichiana*. The latter species has overwhelmingly more young trees, but they appear to be struggling on the nutrient-poor soil. *C. torulosa* are fewer but will likely dominate in the longer run.



Fig. 53: *Cupressus torulosa* trunk and foliage. Near Tukuche, Kali Gankadi, Nepal.



Fig. 54: *Cupressus torulosa*, two massive trunks close to buildings.



Fig. 55: *Cupressus torulosa*, very young seedling with fully juvenile foliage, in sandy river bed soil.



Fig. 56: *Picea smithiana*, showing dense, stunted growth, and aborted cones.



Fig. 57: *Cupressus torulosa*. Almost pure stand, on the edge of a debris cone.
The river carries large boulders in addition to sandy alluvium.



Fig. 58: *Cupressus torulosa* forest on rocky soil.



Fig. 59: *Cupressus torulosa*, Kali Gandaki valley; view across to the town of Tukuche, 2590 m.



Fig. 60: *Picea smithiana*. In this dry environment, it does not show the usual pendulous branchlets.



Fig. 61: *Cupressus torulosa*, old tree.



Fig. 62: *Cupressus torulosa* trunk with fire scars and woodcutting scars. Across the Himalaya and beyond, shepherds cut chips of wood from the base of conifers and use the trunk's natural shelter to make fire. Judging from the cambium regrowth behind the bark, no fire had taken place for many years.



Fig. 63: Same tree as the one in Fig. 62, previous page.



Fig. 64: *Cupressus torulosa*, near Tukuche, Mustang, Nepal. 2700m.



Fig. 65: *Picea smithiana*, showing drought adapted habit, with long upright branches and upright, short side shoots.

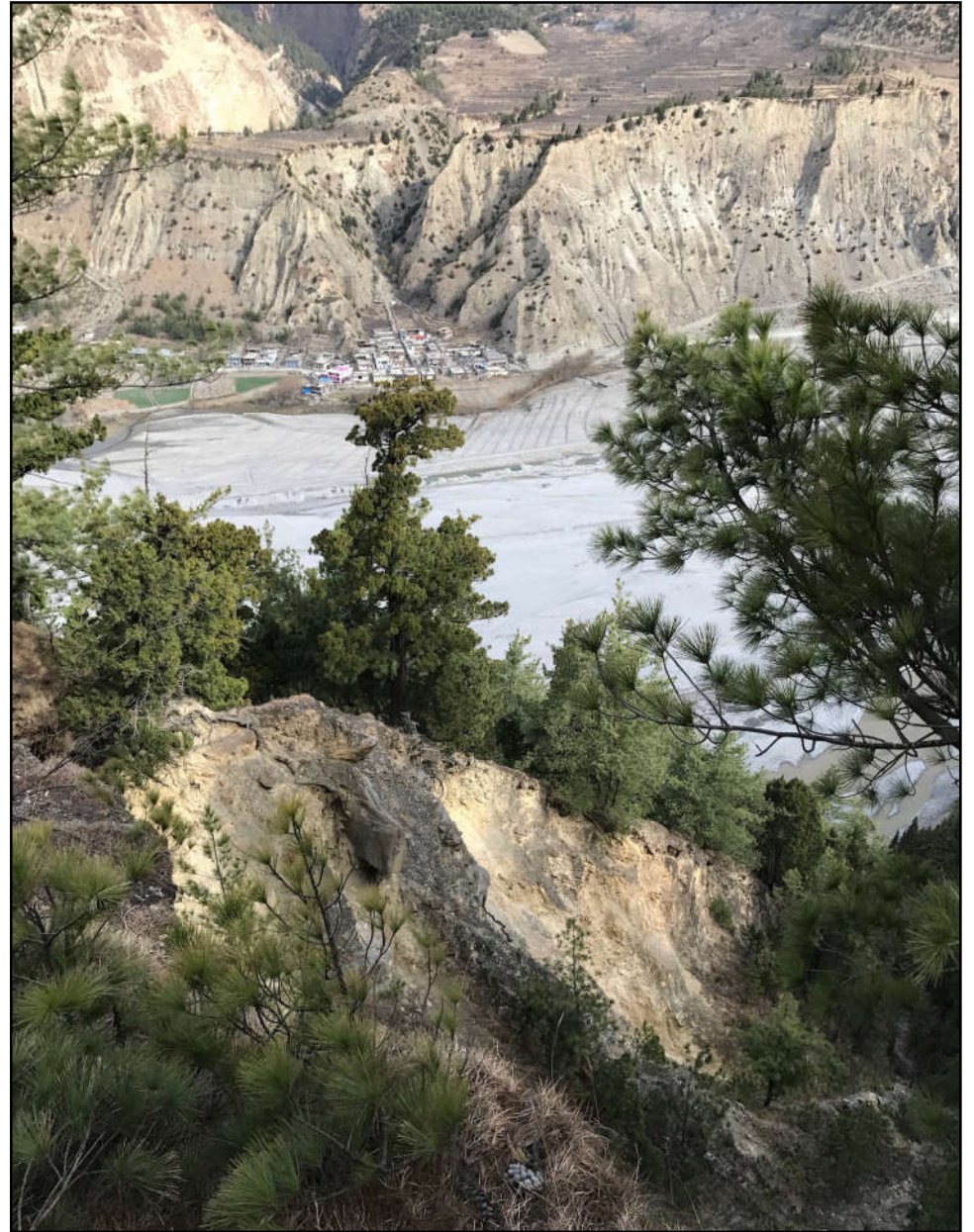


Fig. 66: *Cupressus torulosa* in the centre and centre-left. South bank of the Kali Gandaki, facing Tukucho.



Fig. 67: Mixed *Cupressus torulosa* and *Pinus wallichiana* forest.
The tree in the middle is *Picea smithiana*.



Fig. 68: *Cupressus torulosa* in the centre, among *Pinus wallichiana*.



Fig. 69: *Picea smithiana*, cone.

Fig. 70: *Cupressus torulosa* dominated forest, with some tall trees.
On the left foreground, *Picea smithiana* foliage.

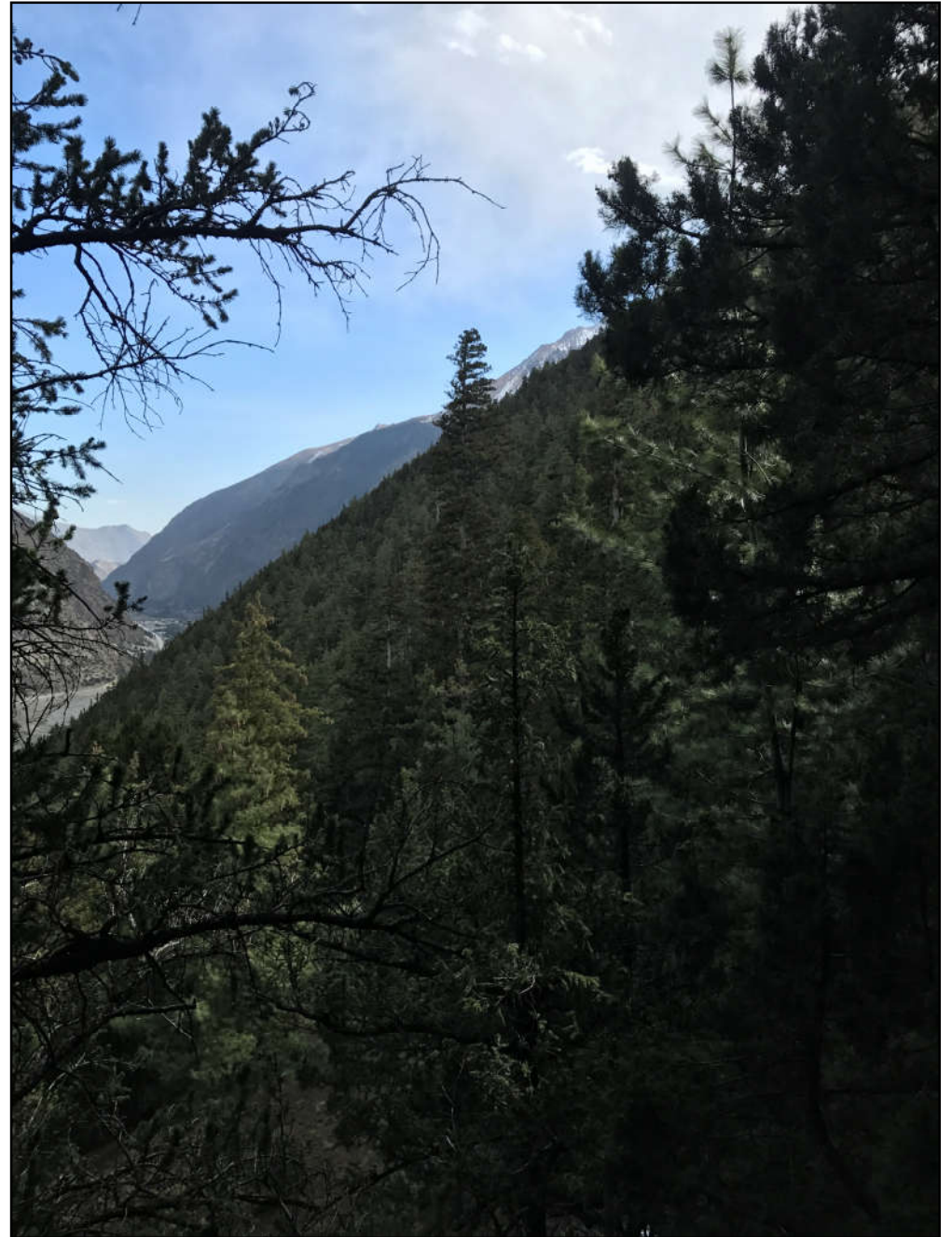




Fig. 71: General view on the Kali Gandaki valley north of Tukuche. On the approximately 6 km stretch where *Cupressus* grows, the river becomes as wide as 1 km, creating a multitude of ever-changing channels. The view illustrates the narrow valley in the background and the place where the channelled portion begins. It becomes again suddenly narrower near Kokhethanti where it makes a 45° bend southward. The river cuts through the Himalayan mountain range. The phenomenon is known as antecedent drainage stream: the river was in place before the orogeny. *P. wallichiana* in the foreground, *C. torulosa* closer to the river bed. Cf. Map 1, p. 34-35.



Fig. 72: *Cupressus torulosa* growing in the alluvial bed of the Kali Gandaki river and on the cliffs near Tukucho.



Fig. 73: *C. torulosa*, Kali Gandaki valley. Tukucho peak in the background.



Fig. 74: *Cupressus torulosa*, foliage close-up. Vigorous regrowth on a cut branch. The new shoot is more yellowish-green than the older foliage.



Fig. 75: *Ephedra gerardiana* on a steep cliff above the Kali Gandaki, with *Cupressus torulosa* on the left and *Pinus wallichiana* on the right.



Fig. 76: *Ephedra gerardiana*, a non-conifer gymnosperm. Foliage close-up.



Fig. 77: *C. torulosa*, foliage.



Fig. 78: *Cupressus torulosa*, Kali Gandaki valley. Typical habitat of riverbed, river bank, and cliffs/dry slopes. Taller trees in the background.

Fig. 79: *C. torulosa*, Kali Gandaki valley. In often-disturbed habitat of alluvial plains and cliffs, it dominates with little to no competition.





Fig. 80: *Cupressus torulosa* near Chhairi, Mustang, Nepal.



Fig. 81: *Cupressus torulosa* along a river that feeds into the Kali Gandaki river. *Pinus wallichiana* (yellowish and light green) is present too, but rarely into full grown trees.



Fig. 82: *Cupressus torulosa* on alluvial rocks from a feeder of the Kali Gandaki. They feature an upright, regular, narrowly conical habit, as they are still young and competing with each other and with *P. wallichiana* (also pictured).



Fig. 83: *C. torulosa*, large tree next to an apple orchard, near Chhairo, Mustang,



Fig. 84: *Cupressus torulosa* on the alluvial banks of the Kali Gandaki between Chhairo and Dhonga.
2650 m (river altitude).



Fig. 85: Gorge next to Thini village, with mostly *Salix* (planted) and *Berberis*. A lone *Pinus wallichiana* stands out. Across the gorge, behind the hill, a denser forest is discernable, made up of *P. wallichiana*, *Cupressus torulosa*, *Juniperus* and angiosperms. Note the ruins of the Gharapjong fort on the hill, and the white chorten.

Fig. 86: *Cupressus torulosa*, and its typical ecological niche: frequently disturbed rocky riverbed, and steep, dry cliffs. Kali Gandaki river. Dhaulagiri massif in the background.

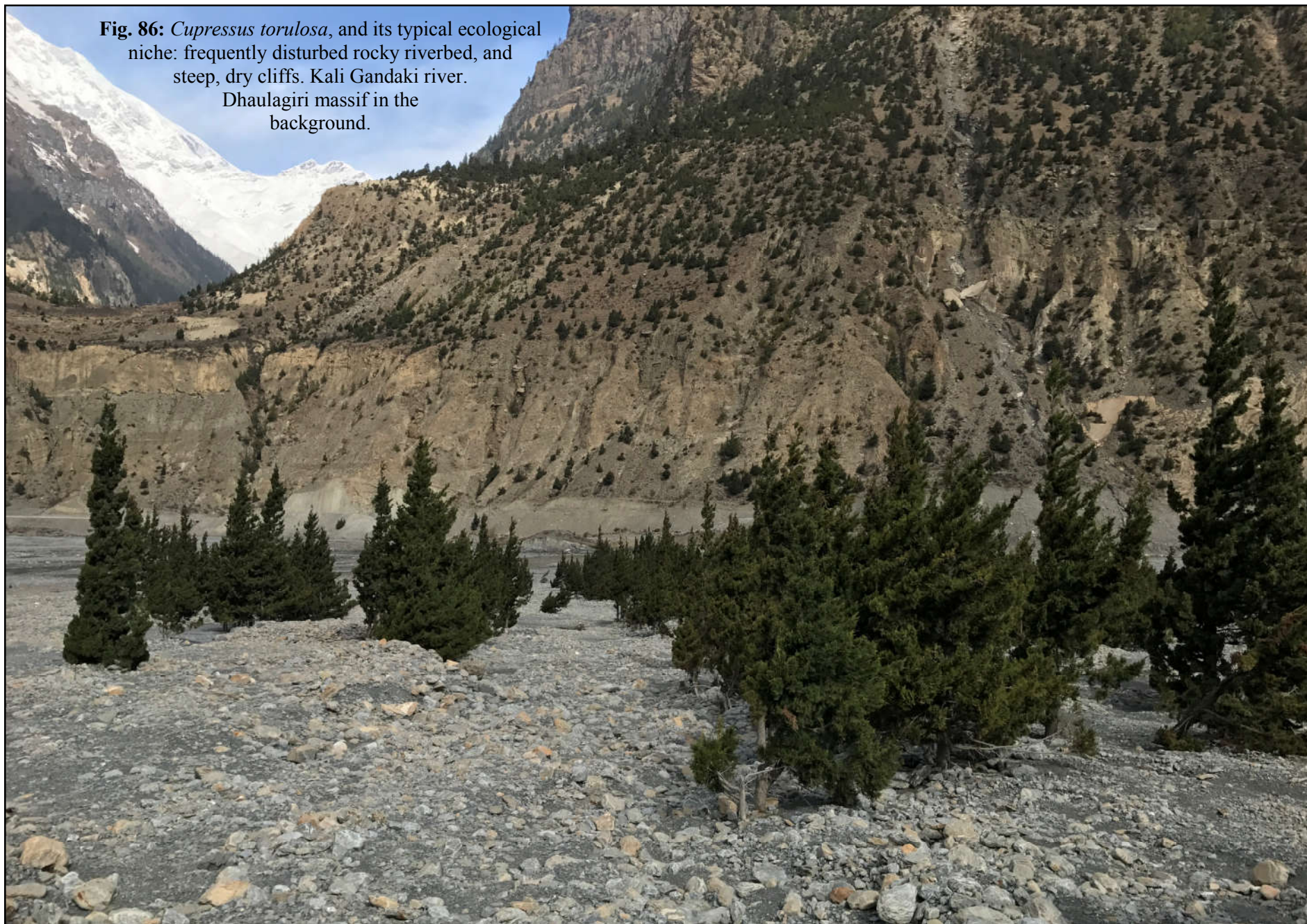


Fig. 87: *Cupressus torulosa*, mixed with *Juniperus* spp., above Marpha. The open forest starts just above the town, at around 2800 m and goes up to approximately 4000 m.





Fig. 88: View on Syang village from the east, across the Kali Gandaki. Apple orchards in the foreground. *C. torulosa* – *Juniperus* spp mixed forest across, on the dry, steep mountain slopes. The first peak above Syang village (2800m), with its very tip in snow, stands at 3900m.

Fig. 89: Thini village (2850m) and its fields and apple orchards. Across the Kali Gandaki, part of Jomsom town and its airstrip is visible. Above it, dry slopes dotted with *Cupressus torulosa* and *Juniperus* spp.

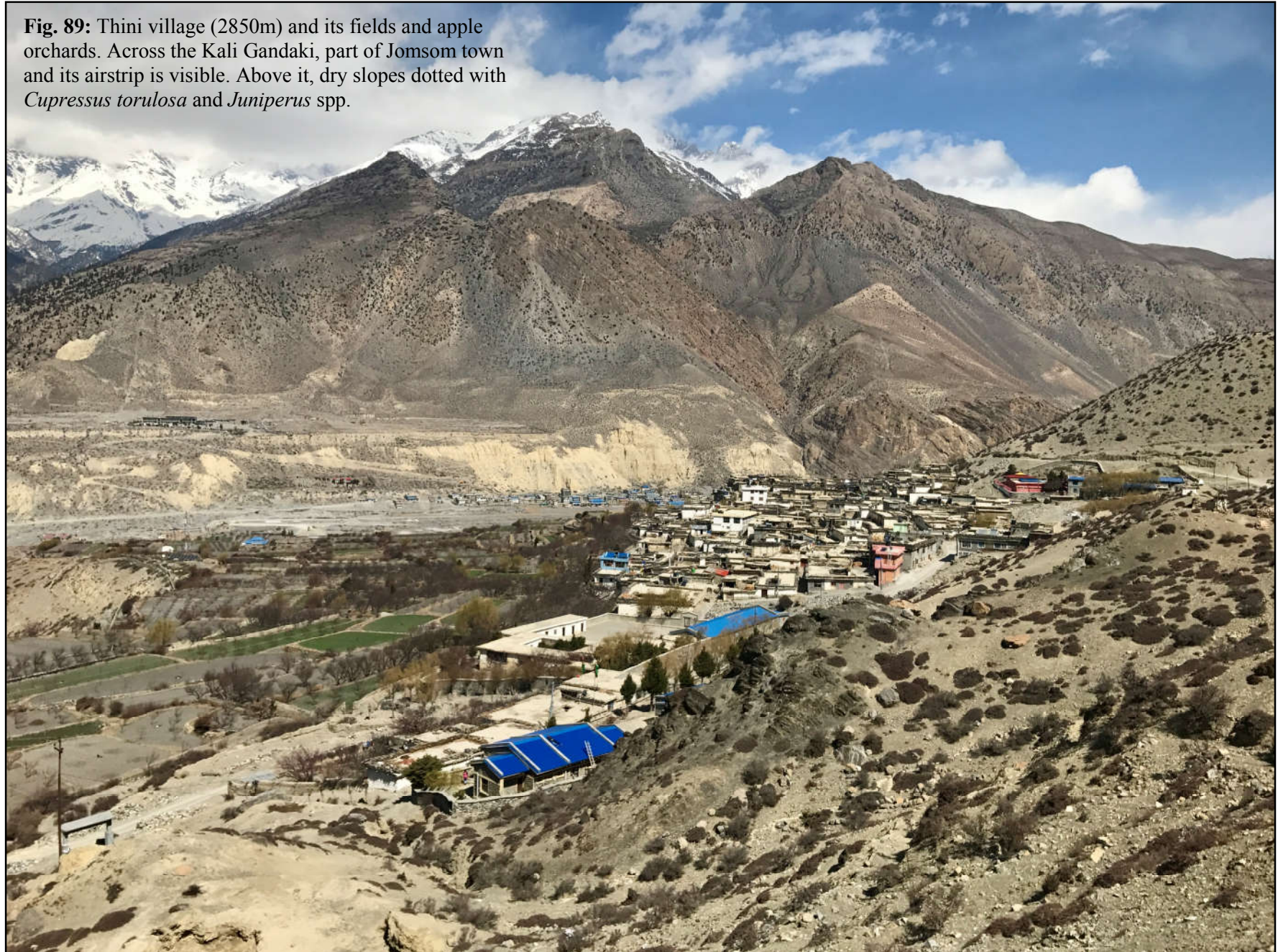




Fig. 90: Seeds cones of *Juniperus indica*.

Fig. 91: Foliage of *J. indica*, 2900m, above Dhumba hamlet.



Fig. 92: Semi-underground stream in between cliffs. A few *P. wallichiana* on top. Down, a single *C. torulosa* is emerging from the *Berberis–Juniperus* thickets.

Fig. 93: *C. torulosa* in the riverbed of the Thini Khola, a tributary of the Kali Gandaki. The river is below the Nilgiri peak (not pictured), 7061m, and carries large amounts of rocks, while wind batters the open landscape. This highlights *C. torulosa* as a pioneer species, adapted to constantly disturbed environment.



Fig. 94: *C. torulosa* in the riverbed of the Thini Khola, a feeder of the Kali Gandaki. Close-up of a cone, on a branchlet that dried out just before the cone's full maturation.





Fig. 95: Sparse, wind battered grove of *Pinus wallichiana* in eroding terrain at 2900m. The shrubby plants pictured here are mostly *Berberis* and *Juniperus*. Dhumba lake in the distance, and beyond, much denser *P. wallichiana* – *Cupressus torulosa* – *Juniperus* forest.



Fig. 96: Mixed *Pinus wallichiana*, *Cupressus torulosa* (centre) and *Juniperus* grove at 2900m, above Dhumba hamlet.



Fig. 97: *Cupressus torulosa*, old tree near Tukuche. 2700m.