WEPPpy Technical Brief

Low-Severity Forest Initial Random Roughness

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1 The Change in Brief

On October 9, 2026, WEPPpy changed standard low-severity forest initial random roughness, `RRINIT`, from **4 to 6 cm** (0.04 to 0.06 m). This corrects an inconsistency in the burned-forest parameter sequence. Targeted tests support more sensible event-level sediment ordering, with negligible runoff changes in the tested cases.[1]

This is a **WEPPpy parameterization change**, not a change to the University of Idaho's `wepp-forest` equations or binaries. One shared management-template field and four corresponding texture rows in the packaged extended land/soil lookup changed. Ridge height (`rhinit`) remains 4 cm. Cover, soil, routing and other roughness defaults were not changed.

Standard class	Unburned	Low	Moderate	High
Forest	10	**4 → 6**	6	6
Young forest	8	**4 → 6**	6	6
Shrub	6	6	6	6
Tall grass	2	2	2	2

All values are centimeters of initial random roughness. Deciduous and mixed forest share the forest values. Burned young forest uses the shared forest templates. These are standard Disturbed mappings, *not universal values for every regional or custom mapping.* Shrub/grass burn remapping depends on project options. Prescribed fire is separate and unchanged.

Who is affected? Projects preparing inputs from the shared low-severity forest template, including the four forest labels above. Other mappings selecting that template also inherit the revision. Different templates, custom overrides and previously prepared inputs may not.

2 Why Roughness Matters

Initial random roughness is a modeled surface condition, not ridge height, Manning's resistance coefficient, canopy height or litter depth. Measured litter thickness should not simply be entered as RRINIT. The initial value also need not persist: the model evolves an effective roughness, denoted here by r.

The retained code assessment traces roughness into depression storage, hydraulic resistance and erosion-related calculations. Thus runoff, peak rates and sediment can respond to this single input. The response depends on soil state, slope and other inputs, not roughness alone.[2]

One existing interrill-delivery factor explains the targeted sediment response:

$$f_r = \max(0, \min(1, 1.14 - 23r)), \qquad r \text{ in meters.}$$

Its cutoff is approximately 0.049565 m, or 4.96 cm. With effective roughness at 4 cm the factor is 0.22; at 6 cm it is zero. Through the existing particle-specific delivery calculation this suppresses the interrill contribution. **It does not turn off all erosion.** Rill erosion, transport and deposition remain separate processes. This describes an existing algorithm, not a new physical law or a code change.

In the tested sandy-loam soil, effective roughness remained at the assigned 4 or 6 cm for all 36,525 days. In the other soils it declined below the cutoff, eventually reaching the model's 0.6 cm floor. This explains why an input revision can persist in one fixture but have no reported runoff or sediment effect in others. It is not a general classification of field soils by texture.[4]

2.1 Why Not Lower All Values?

The preceding 896-run sensitivity study tested four textures, six vegetation labels, four severity states and two slope profiles. It compared class-specific controls with values from 0.6 to 4 cm. Responses strongly depended on modeled soil state. Reducing high-severity forest roughness from 6 to 0.6 cm on the sandy-loam 20% slope increased surface runoff volume by 17.89% and sediment delivery to about 2.91 times the control.[3]

Those findings did not justify a blanket reduction. The adopted correction uses the already established 6 cm burned-forest value for low severity, without changing other parameters to compensate. Improved tested ordering supports the consistency correction; it does not prove calibration against observations. Lower sediment is not a degradation accepted for a neater parameter table.

3 What the Targeted Comparison Shows

The follow-up used 96 fresh canonical controls and 16 low-burn trials: **112 successful simulations**. Four forest labels share burned templates; identical results for a given soil are not independent replications. Only RRINIT changed within each paired comparison.[4]

All cases used the same frozen `wepp_261009_hill` binary and host runtime, synthetic McKenzie Bridge climate (2000–2099; seed 26109), and an 87.9 m by 102.4 m profile with approximately 38.56% mean grade. The follow-up did not include the gentler profile. Surface runoff here is not routed streamflow; hillslope sediment delivery is not channel erosion or watershed outlet sediment.

Soil fixture	Runoff depth mm / 100 yr	Sediment delivery kg / 100 yr	Maximum peak m^3/s
Clay loam	41,620.0 → same	111,737.85 → same	0.11104 → same
Loam	36,859.0 → same	21,630.31 → same	0.13427 → same
Sandy loam	11,975.9 → same	819.45 → 676.12	0.17035 → 0.17038
Silt loam	25,505.6 → same	8,824.65 → same	0.12931 → same

Arrows compare 4 with 6 cm. Runoff depth uses event-by-event (EBE) output; sediment and peaks use hillslope PASS output. Unchanged values refer to the retained reporting precision, not identical internal states.

3.1 Sandy-Loam Water and Sediment

Higher-precision PASS surface volume changed from 107,491.6793 to 107,491.6443 m^3: only -0.035 m^3 over 100 years (-0.0000326%). All 743 PASS event dates and 808 EBE dates were retained, with no new or lost runoff-event dates. Peaks changed on 28 dates; the largest relative change was approximately -0.508%, and the 95th-percentile peak was unchanged.

PASS sediment decreased **17.49%**, from 9.10 to 7.51 kg/ha/year over the 0.900096 ha slope. Delivery decreased on 30 dates, increased on none, and became zero on 24 previously positive-delivery dates. Annual totals changed in 25 of 100 years. This is persistent, event-selective behavior, not uniform scaling or proof of physically zero sediment on those days.

The largest event mass decrease was 298.156 to 283.585 kg (4.89%); another event fell from 9.041 kg to zero. Rounded EBE delivery decreased 15.19%, not 17.49%; its kg/m measure differs from concentration-derived PASS mass. The existing PASS surface-volume minus EBE depth-equivalent discrepancy changes from -302.9176 to -302.9526 m^3. No accounting-closure repair is claimed.

4 Rankings, Limits and User Actions

4.1 Improved Events, Not Universal Monotonicity

Across the union of 3,465 sandy-loam mature-forest PASS event dates, there were 17 dates where low-severity sediment exceeded moderate-severity sediment at 4 cm, and none at 6 cm. Absent EVENT sediment is counted as zero in this comparison. After revision, unburned $\leq$ low $\leq$ moderate $\leq$ high delivery holds on every compared date.[4]

Full-record rankings are distinct: runoff remained ordered in 23 of 24 soil/vegetation contexts, sediment in 24 of 24, and record maximum peak in 18 of 24. No full-record ordering failures were introduced or removed. Remaining peak/runoff exceptions are not grounds to tune for a monotonic table.

Evidence covers one synthetic climate, four soil fixtures and a steep profile. It does not establish field sediment accuracy, watershed outlet response, subdaily timing parity, recovery through time or other-climate behavior. The parameter study's 261009 identity is retained although that binary was subsequently withdrawn. The separately refreshed canonical benchmark uses 261010; it is not a replacement label for the historical comparison.

4.2 What Users Should Do

1. **Check project inputs.** Low-burn forest should receive 0.06 m when the revised shared template is selected and not overridden. Inspect prepared `p*.man` files, not just a class label, displayed table or binary version.
2. **Regenerate deliberately.** Existing prepared files, project-local managements and exported lookups are not automatically migrated. Regenerate intended management artifacts and verify values before rerunning. Preserve user-specified overrides.
3. **Keep passes compatible.** Watershed reruns require fresh hillslope PASS files from the same WEPP build as the watershed executable. Do not reuse cross-version passes.
4. **Interpret sediment in context.** Lower low-burn delivery may follow this correction where effective roughness persists. Unchanged hillslope runoff does not prove unchanged outlet sediment or require every small event to deliver sediment.

The extended lookup's four affected texture rows were updated; the base lookup has no RRINIT column. Custom managements and generic initial-condition overrides retain their precedence. Unrelated template/export discrepancies and regional mappings were not normalized by this revision.

Representative observations or independent cases showing unacceptable small-event sediment loss or other material regressions would justify review. Rollback restores the shared template and all four lookup cells together; it does not tune other parameters implicitly. This brief does not rerun projects or authorize deployment.

5 Decision and Evidence Record

The accepted decision is ADR-0083. Implementation: WEPPpy commit

`bae734d71165e58d610d5282d41684113b18b4ff`

Study binary SHA256:

`37d8deaf7a4c78e83104db4d896db3ee10b77a5f5d3f3abe5ad718390e2cc228`

Implementation readback verified one template field and four lookup cells changed: `ini.data.rrinit` in `Low_Severity_Fire.man` and the four corresponding rows in `extended_land_soil_lookup.csv`. All 16 generated low-forest managements parsed to 0.06 m and retained 0.04 m ridge height. Retained studies preserve setup failures, runtime distinctions, controls and input/output receipts; they have not been silently regenerated against today's defaults. The canonical climate and deterministic generator are committed. No private watershed is a prerequisite for this document's compilation or a mandatory publication gate.

For current benchmark expectations, see the current canonical Disturbed rankings report. Check its version and input identities separately from this point-in-time brief.

References

[1] WEPPpy (2026-10-09). *ADR-0083: Low-Severity Forest Initial Random Roughness*. Accepted decision, implementation scope, limitations and rollback. Pinned decision record.

[2] WEPPpy (2026-10-09). *RRINIT Assessment and Sensitivity Decision*. Historical pre-adoption inventory, model data flow and equation analysis. Pinned assessment.

[3] WEPPpy (2026-10-09). *RRINIT Sensitivity Study: WEPP 261009*. 896-run study, climate provenance, soil-state dependence and limits. Pinned sensitivity study.

[4] WEPPpy (2026-10-09). *Low-Severity Forest: 4 Versus 6 cm RRINIT*. 112-run study and same-date severity comparisons. Pinned targeted assessment.