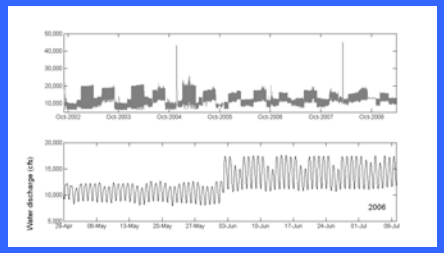
Sand budget modeling

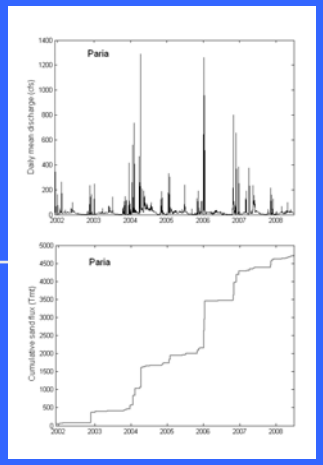
We've developed a sand routing model that can be used to predict downstream sand budgets, based on dam releases and tributary inputs

Model concept

Mainstem flows for the reach



Paria sand inputs, by grain size



sand volume by grain size in reach

Export predicted based on flow, grain sizes in reach

Model applies mass conservation to keep track of the volume of each grain size in reach

Model was calibrated using data from sand transport monitoring program

If you want to know more:

Wright, S.A., Topping, D.J., Rubin, D.M., and Melis, T.S., in press, An approach for modeling sediment budgets in supply-limited rivers: *Water Resources Research*.

This should be available on-line this month

Flood experimental question:

Can a series of sand-enriched floods result in cumulative increases in sandbar size?

Previous individual flood experiments (particularly 2004 and 2008) have demonstrated their efficacy for increasing sandbar size. The next step is to evaluate longer time scales and multiple floods.

Flood parameters

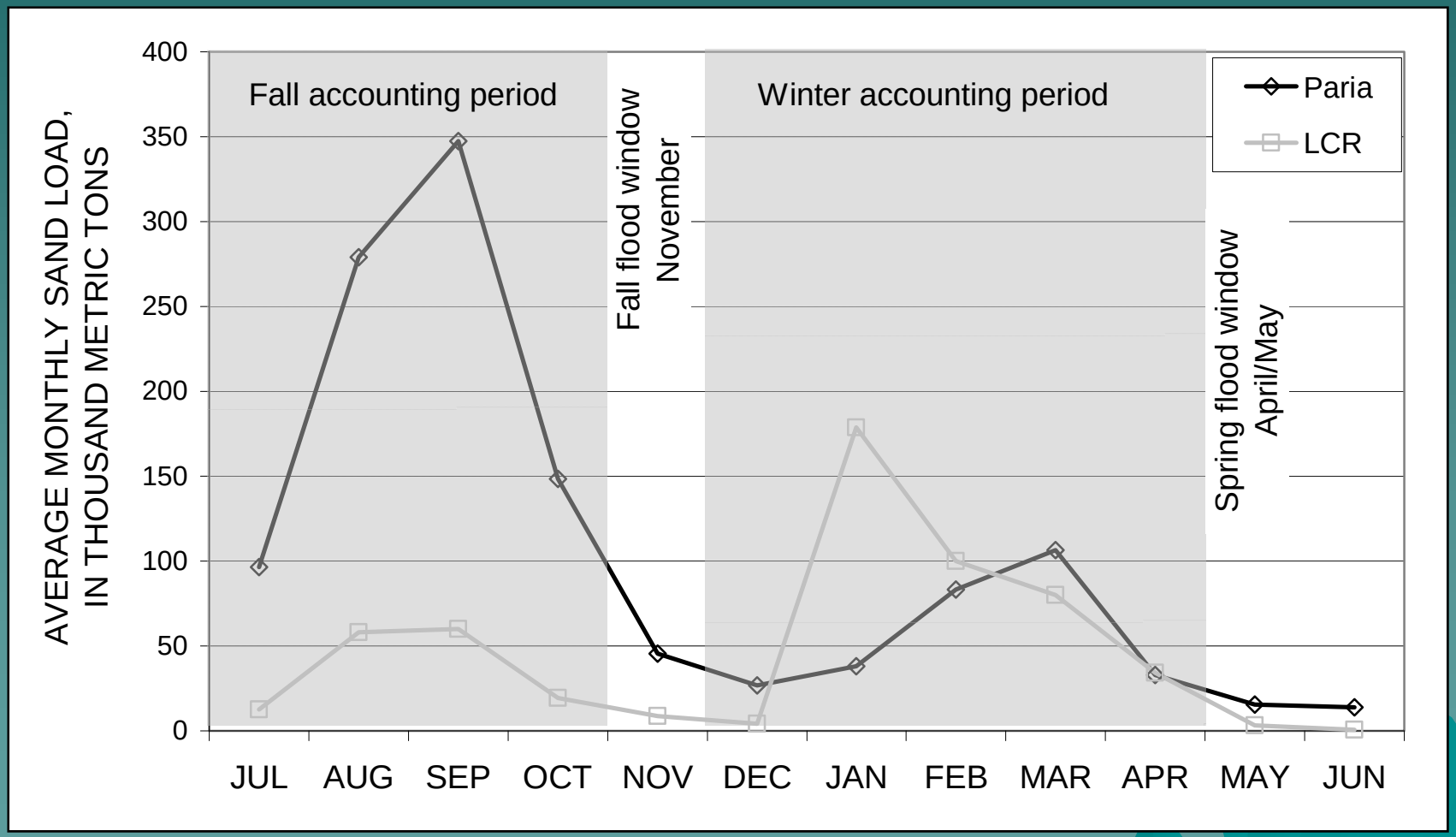
Timing and frequency: The most effective method to build sandbars is to conduct floods soon after tributary inputs. However, logistical constraints exist such that planning time is required for implementation.

Peak and duration: The flood hydrograph shape should depend on antecedent sediment conditions for each event. A range of peaks and durations is desirable.

A flood protocol with flexibility will be most effective at managing sand resources. A range for each parameter could be defined with flexibility within that range.

Timing Example

2 accounting periods and 2 flood windows per year



Frequency Example

Flood frequency depends on the threshold sand level that triggers a flood. This threshold must be set, but flexibility would have benefits:

The basic concept is that any given flood should not export more sand than has accumulated during the preceding accounting period.

A reasonable target for flood export is 50-75% of accumulated sand, leaving 25-50% behind (presumably mostly in sandbars).

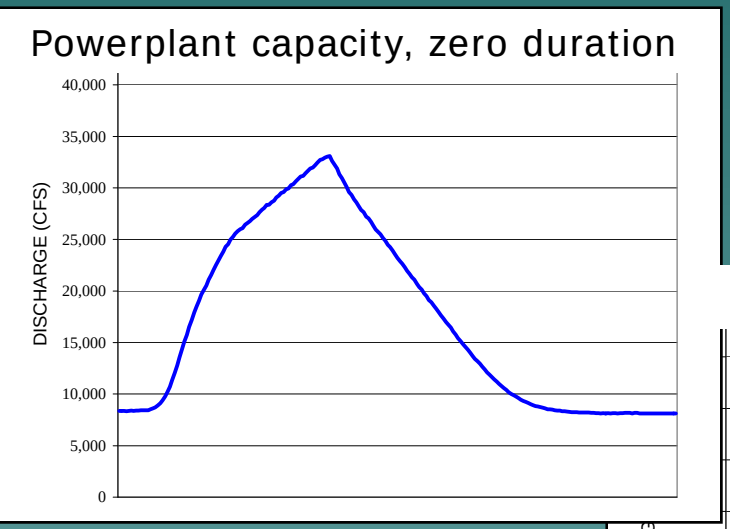
Thus, a flood should occur when the “minimum hydrograph” (e.g. pp capacity, zero duration) would export no more than 50-75% of new sand.

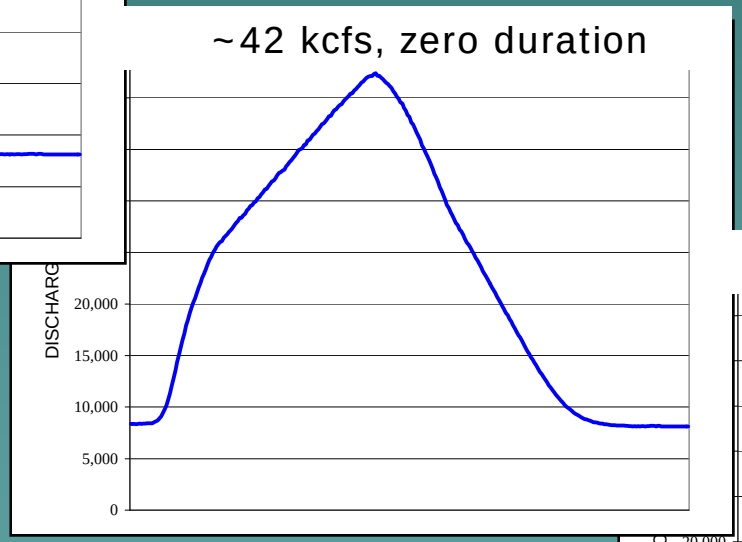
A range for this threshold could be set using existing data and models. Using this, a frequency could be estimated. But since export during a flood depends on antecedent conditions, flexibility to use data and models in real-time to make the determination has merit.

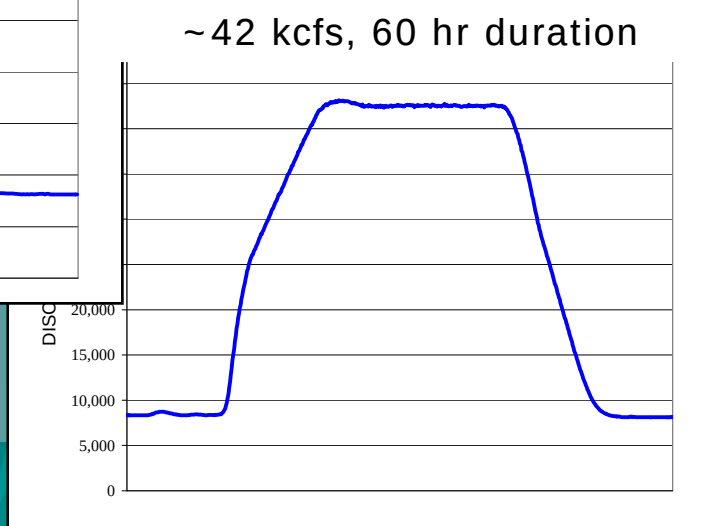
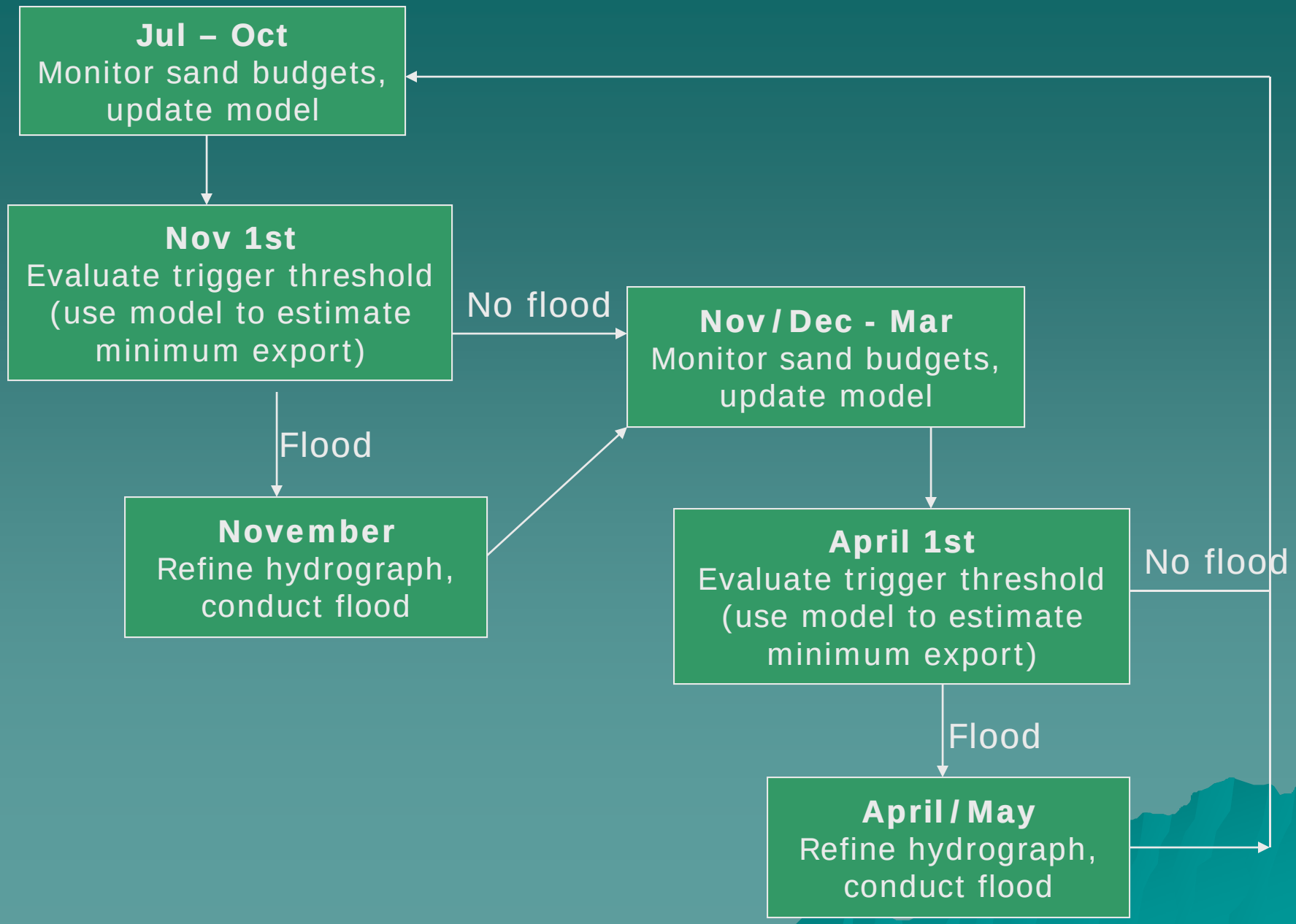
Hydrograph Shape Example

A range of hydrograph shapes could be defined

Actual hydrograph shape for each event would be determined using recent data and models







Example flow chart