

An Index to Cottonwood Establishment Potential

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Abstract: The logic and an application of a program that calculates the potential for the establishment of cottonwood and other riparian trees along rivers in arid North America is the topic of this paper. Establishment of cottonwood is essentially restricted to riverine sites that are moist and have clean substrate. Seedlings can become established on moist, open areas along the edge of the channel and within the channel. Streamflows following establishment may remove many of the seedlings. Data for a USGS gage on the Virgin River in Southwestern Utah is used as an example in the presentation of a computational procedure for an index to the potential for establishment. Three indices are presented: 1) peak streamflow establishment, 2) linked peak streamflow establishment, and 3) establishment width. Peak Streamflow establishment index: a commonly held view is that floods establish the vegetation in the riparian zone of a river; the peak streamflow establishment index is the magnitude of the annual maximum streamflows that exceed the bankfull discharge. Linked peak streamflow establishment index: a concern with the peak streamflows establishment index is that seeds deposited on substrate may germinate and seedlings grow but if the substrate is in the stream channel because the maximum flows in the year are low the seedlings will be destroyed by streamflows following establishment during the next couple of years; the linked peak streamflow index for a year is zero if the streamflows in a destruction period following the establishment period are higher. Width establishment index: the logic is the same as the linked peak streamflow index with the streamflows transformed to a width related factor. The concepts related to the width index illustrate the linking of peak streamflows to following streamflows. The width of a river is calculated using the simple power law $W = a \cdot (Q^{**b})$ where W is the width, Q the stream flow, and a and b are constants. If the streamflow available to prepare an area for cottonwood establishment during the establishment period is QEST, and the discharge following the establishment period limiting the area available for establishment is QDST. Then the width available for establishment (WEST) is $WEST = a \cdot ((QEST^{**b}) - (QDST^{**b}))$. Dropping the a term gives an index of $ESTI = (QEST^{**b}) - (QDST^{**b})$. For the Virgin River index model the establishment discharge was the maximum average 4-day discharge in the period germination period (15 April thru 15 July). A minimum discharge can be specified that essentially prevents the index from being other than zero when the streamflows in the establishment period are less than the specified minimum. Typically, the minimum discharge will be the bankfull discharge.

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