Restricting development rights in order to protect water supplies increases a community's property values but decreases the value of downzoned properties.

Sharing the Burden of Water Supply Protection

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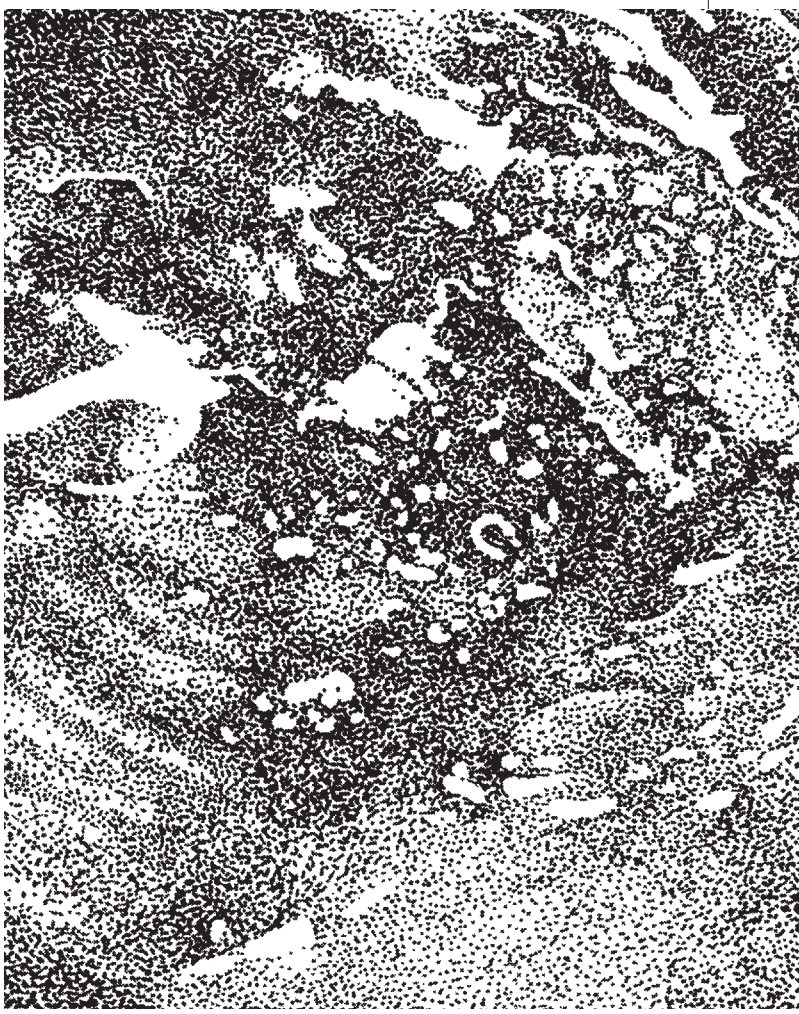
A sufficient supply of freshwater is critical to human survivability and biodiversity. Much of the recent decline in freshwater biodiversity and overall freshwater ecosystem health is attributable to land use change. Land use practices that influence freshwater include agriculture, forestry, mining, industrialization, and urbanization. While agriculture has historically been viewed as the land use practice most likely to adversely affect water quality, urban development is now seen as the greatest threat to freshwater ecosystems in certain parts of the United States.

The general effects of urban development on water quality and watershed health can be grouped into three primary areas: alteration of the hydrologic cycle, manipulation of the physical habitat, and contamination of the water chemistry. For example, urbanization influences the hydrological cycle by increasing impervious surface coverage such as roads, driveways, and rooftops. The impervious surfaces reduce water infiltration into the soil, increase surface flow, and alter flood patterns, causing potential damage to private property and endangering the local population. Urbanization can also alter water chemistry by increasing the prevalence of freshwater contaminants from landscaping, construction activity, and roads.

Watersheds are the source of freshwater ecosystems. A watershed is defined as the land area that drains water to a particular stream, river, or lake. It can be identified by tracing a line along the highest elevations between two areas on a map, often a ridge. When development in a watershed increases density and/or impervious surface volume, the health of the water supply can be adversely affected. This imposes a negative externality on those outside the watershed



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who rely on it for drinking water and other uses such as recreation, waste removal, electricity, and flood control. In the absence of regulation, it is often argued, development in the watershed will exceed the optimal level because the full social cost of each development project is not borne by the private developer or land owner.

This article examines how watershed regulations that restrict the density of development are capitalized into land values. From the manner and extent of capitalization we can infer some information about costs and benefits of watershed regulation as perceived by land market participants. If land use regulations in a watershed contribute to cleaner water than in their absence and residents benefit from the continued provision of clean water then we would expect watershed regulations to correlate with higher land prices. On the other hand, restrictions on the density of development, and hence the ability to subdivide, would tend to decrease the value of land burdened by the regulation. We might generalize the effect of restricting development in a watershed as placing all the direct costs on owners of vacant land in protected watersheds, while providing benefits to those downstream of the protected area. Because any indirect costs incurred to develop, administer, and enforce development restrictions in the watershed are borne by all land owners, we expect the net effect of watershed regulation to vary according to where land is located.

We examine the effect of North Carolina's Water Supply Watershed Protection Act (WSWPA) regulation on vacant land prices in Buncombe County, NC. Development restrictions mandating minimum lot sizes of two acres in the Ivy River watershed were imposed in 1998, after an unsuccessful challenge to the constitutionality of the act and a short-lived effort to exempt Buncombe County's Ivy River watershed from the act. Buncombe County, in the heart of the mountains of western North Carolina, is part of southern Appalachia, where dramatic agricultural intensification during the first half of the twentieth century gave way to post–World War II economic transformations that resulted in a large-scale migration out of area. This emigration began the transformation of southern Appalachia's economy, during which agriculture has consistently declined in importance and the service sector, especially tourism and residential development, has become more important. Pressures that accompany development have been substantial in North Carolina, where total cultivated land area in the state declined by 32 percent between 1945 and 2002. Further, the state's population is expected to increase by 50 percent over the next quarter century, affecting up to 8 million acres of natural land.

BACKGROUND

In the 1970s, watershed regulation in North Carolina was under the authority of the Environmental Management

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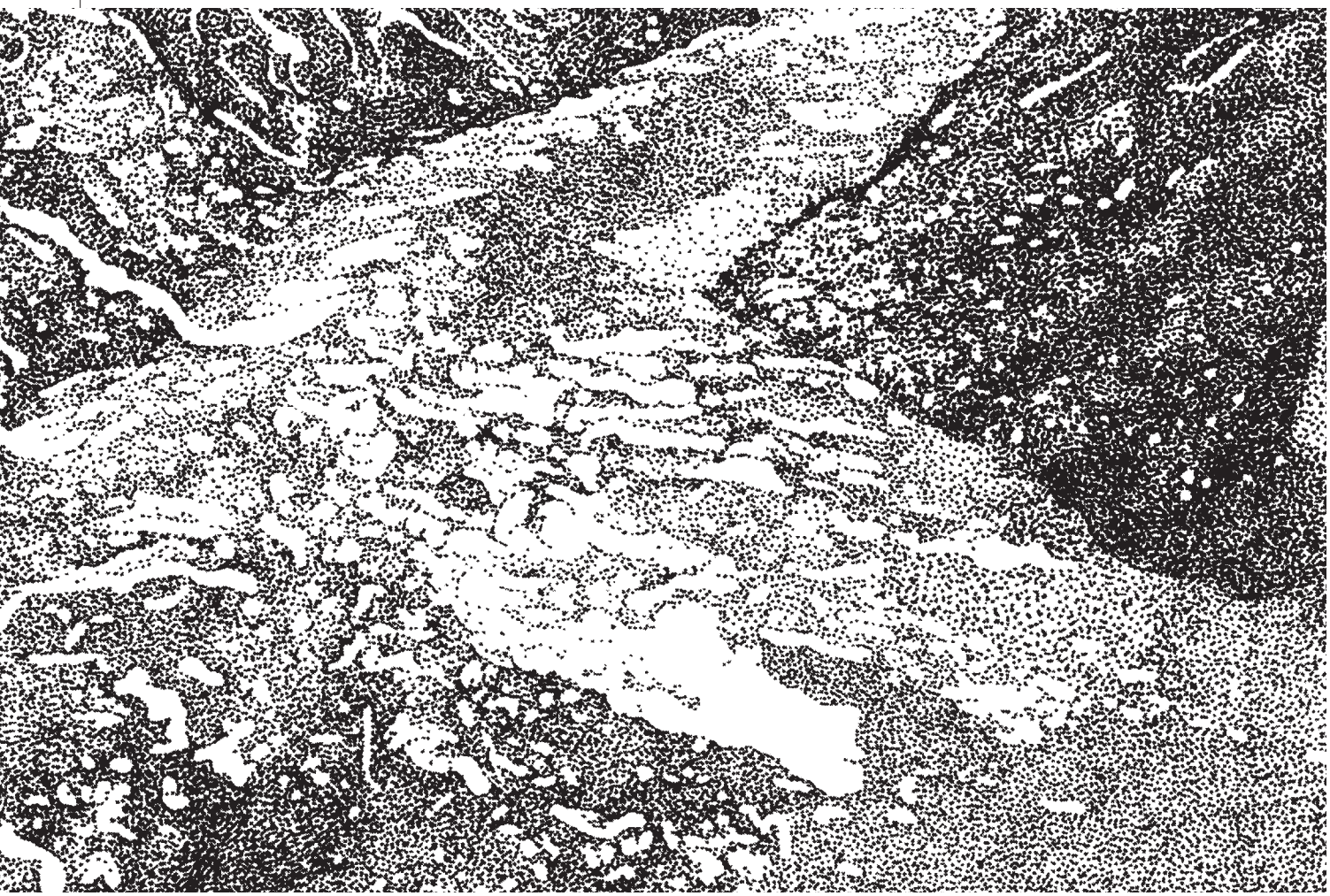

Commission (EMC), which operates through the Division of Natural Resources and Community Development. The EMC was created with the passage of the Clean Water Management Act of 1972 by the U.S. Congress. Formally, the EMC had responsibility to "promulgate rules to be followed in the protection, preservation, and enhancement of the water and air resources of the State."

The classification of public water supplies was one of the EMC's responsibilities. Prior to 1985, a dual classification system classified drinking water sources in North Carolina as either isolated pristine and not requiring filtration, or not. In 1984, the EMC set out to develop a new system that would distinguish between headwater supplies and "run of the river" supplies, the latter of which are generally more susceptible to pollution. In 1985, the EMC proposed a three-category system, which the Natural Resources Division incorporated into a voluntary water supply protection program in 1986.

In 1987, the North Carolina General Assembly introduced legislation to impose minimum watershed protection measures throughout the state. This was not supported by most local governments. A panel was commissioned to determine whether the state's involvement in imposing minimum standards was required to achieve adequate water protection or whether the protection of water supplies could be left to local governments. In 1989, after concluding that state-imposed minimum standards were, in fact, needed, the Legislative Study Committee on Watershed Protection drafted a watershed protection bill.

The Water Supply Watershed Protection Act of 1989 required local governments to adopt protection measures in watersheds at least as restrictive as the state's minimum standards. Implementation and enforcement of the WSWPA was given to the EMC. Further, new revised water supply classifications, standards, and management requirements were to be adopted by the EMC by January 1, 1991. Public hearings were held in August 1990 regarding the EMC's proposed regulations, and protective regulations were adopted in December of that year. However, in the face of widespread complaints that the new rules were too restrictive, the EMC resubmitted the regulations to the public comment process and revised regulations were adopted in February 1992. In May of 1992, the EMC reclassified all watersheds in North Carolina. Local governments with land use planning jurisdiction were required to adopt and enforce local water supply protection plans and ordinances by January 1, 1994 for potential water supplies, regardless of when they might be used.

The new watershed regulations feature a five-tier water supply classification system, where a higher classification generally carries stricter development rules. The highest classification, WS-I, applies to waters within essentially natural and undeveloped watersheds. These watersheds are on publicly owned land and have no permitted point source (wastewater) discharges. The WS-II classification applies to predominantly undeveloped watersheds that do not qualify for WS-I classification. The WS-III classification applies to low to moderately developed watersheds, while the WS-IV classification applies to land in moderately to highly developed watersheds. The WS-II, WS-III, and WS- IV classifications vary by whether the land is located within a critical area, defined as within one-half mile of the water source, and hence subject to greater risk of pollution. Finally, the WS-V classification has no categorical restrictions on watershed development, and local governments are not required to adopt watershed protection ordinances.

Local governments can use either a free-standing watershed ordinance to enforce the regulations or can do so through the adoption of a zoning ordinance. Residential, commercial, and industrial uses can be regulated through density limits, limits on built-upon area (the amount of impervious surface area on a site), stream buffers, development clustering, and structural storm water control devices.

Challenges In the mid-1990s, the reach of the WSWPA, as it applied to the Ivy River watershed, was challenged directly and indirectly. First, the Ivy River watershed was specifically exempted from the WSWPA. North Carolina state senator Herbert Hyde, from the 28th district (which includes Buncombe County, of which Asheville is the county seat), proposed an amendment to House Bill 686. Known as the Hyde Bill, the amendment laid out numerous criteria that, if all met, would exempt a water supply watershed from the WSWPA:

> Notwithstanding any other law, the provisions of G.S. 143-214.5 shall not apply to any water supply watershed area classified as WS II by the Environmental Management Commission prior to July 1, 1993 and formerly classified as Class C, comprising 70,000 acres or more but less than 75,000 acres in watershed and protected area lying in two or more counties, one of which has land use jurisdiction therein, and part of which lies in the land use regulation jurisdiction of a city or town, having a point of elevation of at least 1,650 feet above sea level and was not being used as a water supply for any municipality on July 1, 1993, said area also lying adjacent to a third county which lies within the same two-member State Senate district as do all or parts of the other two counties.

In the entire state of North Carolina only Buncombe County's Ivy River watershed met the Hyde Bill's criteria for WSWPA exemption. The Hyde Bill, which was enacted in July 1993, safeguarded any such exemption until the EMC reclassified the area and removed any designated critical area, and until the General Assembly enacted certain legislation.

A second challenge to the WSWPA came through the courts. In the fall of 1996, in *Town of Spruce Pine v. Avery County*, the North Carolina Court of Appeals ruled that the WSWPA was an unconstitutional delegation of legislative power to the EMC without adequate guiding standards. The case went to the North Carolina Supreme Court, which overturned the decision in July 1997, thus upholding the constitutionality of the WSWPA. The court also ruled that the Hyde Bill's statutory exemption of the Ivy River watershed, which may have been unconstitutional, could be severed from the act, and the rest of the act remained constitutional.

On October 24, 1997, Buncombe County received a letter from the state that read in part, "In light of the recent NC Supreme Court decision ... the Division of Water Quality is

notifying all local governments with land use jurisdiction in the Ivy River WS-II watershed of the requirement to adopt and implement water supply watershed protection ordinances in accordance with the statewide rules governing drinking water supply watersheds." Buncombe County drafted a new ordinance, consistent with the state-wide legislation, and this ordinance became effective on July 7, 1998.

AN EMPIRICAL STUDY OF WATERSHED REGULATIONS

In this study, the effect of watershed regulation on land values is revealed through a comparison of vacant land prices before and after the effective date of new development restrictions. A hedonic regression model is used to ascertain how changes in watershed restrictions affect land prices. Within the hedonic framework, a land parcel is a bundle of characteristics, each of which contributes to the parcel's sales price. In general, we expect that vacant land prices are related to time of sale, lot size, distance from an employment center, and various other physical or legal attributes. In this case, two of those latter characteristics are location within the regulated watershed and whether the sale occurred after the effective date of the watershed regulations.

In our empirical model, variation in sales price of vacant land is explained by lot size, distance from Asheville, and adjacency to U.S. Forest Service land or the Blue Ridge Parkway, among other things. Parcel information and sales information were obtained from the Buncombe County property appraiser. This information is matched with data generated by Geographical Information Systems to create variables related to location, such as whether the parcel lies within the Ivy River watershed and whether the parcel obtains water from the Asheville water system or receives any surface water originating from the Ivy River water basins. The working sample includes 11,304 qualified vacant land sales that occurred in Buncombe County between January 1, 1996 and December 31, 2007. According to the three-part water source classification described earlier, 123 sales involved parcels that received surface water benefits from the watershed protection and 5,403 parcels are supplied by Asheville's public water system. The remaining 6,353 parcels in the sample are supplied by private subsurface wells and private reservoirs.

Our hedonic analysis is designed to reveal any difference in price between the pre-ordinance and post-ordinance periods. The entire Ivy River watershed is designated a WS-II Critical Area, and hence subject to a minimum two-acre lot size requirement. The two-acre minimum lot size implies that a parcel less than four acres cannot be subdivided. We accordingly expect the impact of the restrictions is greatest on these parcels than for those greater than four acres. (Properties less than two acres in size could still be developed.) Because we expect the loss in value imposed by the restrictions on subdivision is most severe for properties less than four acres in size, the model accommodates a different land value/parcel size relationship for these properties. We also control for whether the development effects of the land use ordinance were isolated to the watershed and whether there were any positive effects of the land use policy on downstream properties not in the watershed; that is, whether those properties experienced a positive spillover effect from the policy. We expect amenity benefits to accrue to those living adjacent to creeks, those who rely on the Asheville water supply for their drinking water, and those who receive their water supply directly from the Ivy River.

> Property owners who benefited from the watershed policy could be taxed in order to compensate those who were harmed.

MAJOR FINDINGS

Our analysis reveals a substantial negative impact of the development restrictions embodied in the watershed protection on those watershed properties for which subdivision was made infeasible. We find that vacant parcels in the watershed less than four acres in size and sold after the development restrictions came into effect were 36 percent lower in price than otherwise similar parcels.

However, the analysis suggests there were at least two distinct groups of property owners who gained from the policy even while some landowners in the watershed experienced losses because of the policy. Those vacant properties adjacent to a creek experienced a 10 percent increase in price, on average, after the watershed policy went into effect. Furthermore, vacant land serviced by the Asheville water system experienced an average increase in price of approximately 15 percent. Owners of properties that receive surface water from the Ivy River watershed did not experience a statistically significant impact, positive or negative, on property values after the policy was enacted.

The property owners who gained from the watershed policy could be taxed directly or indirectly in order to compensate those property owners harmed by the watershed policy. We examined 331 transacted watershed parcels in the sample, of which 250 were less than four acres in size. Of those smaller parcels, 208 were sold after the watershed restrictions were implemented. Combining the estimated effect of the land use policy on parcel prices in the watershed and the actual trans-

action prices of affected properties, we calculate that property values fell on average by $10,368 (measured in 2000 dollars). Thus the total estimated cost of the watershed restrictions, reflected in 1,294 parcels of less than four acres existing in the watershed in 2001, was $13,416,192. In 2001, there were 48,568 residential parcels on Asheville's surface-water-fed public water system. Therefore, a per-parcel tax of approximately $275 would have been sufficient to compensate property owners harmed by the watershed policy. This is far less than the average estimated real price increase of $18,492 for those properties on the Asheville public water supply.

Admittedly, the study does not include various additional private and public pecuniary and non-pecuniary benefits and costs of watershed management policy. For example, the Ivy River watershed also lies in Madison County, NC, which was not included in our analysis because of insufficient data. In addition, the study understates the benefits to the extent that it ignores a positive non-excludable environmental amenity effect of the watershed restrictions.

CONCLUSION

Economic theory suggests that efficient public policy generates enough pecuniary and non-pecuniary benefits for proponents to compensate any who suffer economic damages from the policy. To the extent that the effects of watershed protection are capitalized into vacant land prices, our analysis reveals measurable costs to affected landowners in the catchment area from North Carolina's WSWPA for whom flexibility in land development is compromised. While we lack estimates of all economic costs and benefits to the broader society served by the watershed, the analysis suggests that some form of compensation from the population that benefits from the watershed protection policy to adversely affected property owners may have been justified.

Because restricting the development rights of landowners located in a watershed results in an inequitable distribution of costs and benefits from protection of the water supply, we might consider what market-based alternatives are possible. Policies based on property rights and markets can more equally distribute costs and benefits and can provide landowners with incentives to maintain or create conditions that bring about water supply protection. For example, Allan K. Fitzsimmons has proposed a transferable development rights program concerning watershed protection, similar to transferable land conservation tax credits. Using the established classification system, a watershed protection certificate could be awarded to land owners for each acre restored under an enforceable agreement. Certificates could be bought and sold, thus establishing a market for the certificates by requiring permits for damaging activities. Regulators would issue permits whenever a petitioner presents a requisite number of certificates, where the number of certificates needed to secure project approval would depend on the watershed designation. Because the certificates would be paid for by the public in return for water supply protection, the burden of supplying the public benefit of clean surface water is shifted from the private sector to the general public. Furthermore, one could tax those who receive the direct benefits from the water supply protection to pay for the certificates, thereby increasing the efficiency of the transfers between those who supply and those who demand the public benefits.

Market-based solutions might be both efficient and practical, given the relatively small geographic scope of most watersheds.

Our analysis suggests that legislative remedies to perceived negative externalities may cause unintended consequences and economic hardship on those who are "in the wrong place at the wrong time." The alternative of allowing the market to determine the value of land and, in the process, sending signals about the value of water quality is a difficult alternative for many who are ideologically opposed to market-based alternatives. The most likely complaint would be that any market-based alternative would prove difficult to introduce and difficult to enforce, yet such alternatives might be both efficient and practical given the relatively small geographic scope of most watersheds.

While a perception that there is a "point of no return" after which water quality is permanently damaged seems to dominate the political and philosophical debate, it is far from obvious that legislative solutions provide equitable or efficient solutions to ecosystem management and protection. Perhaps the empirical evidence from Buncombe County and the political machinations that were undertaken pertaining to the Ivy Creek watershed can provide a warning about the economic impact of such policies and the potential politicization of the process, which often runs counter to efficient economic policy. R

Readings

- *Defending Illusions: Federal Protection of Ecosystems*, by Allan K. Fitzsimmons. Rowman and Littlefield, 1999.
- "Watershed Development Restrictions and Land Prices: Empirical Evidence from Southern Appalachia," by John F. Chamblee, Carolyn A. Dehring, and Craig A. Depken II. *Regional Science and Urban Economics*, Vol. 39, No. 3 (2009).